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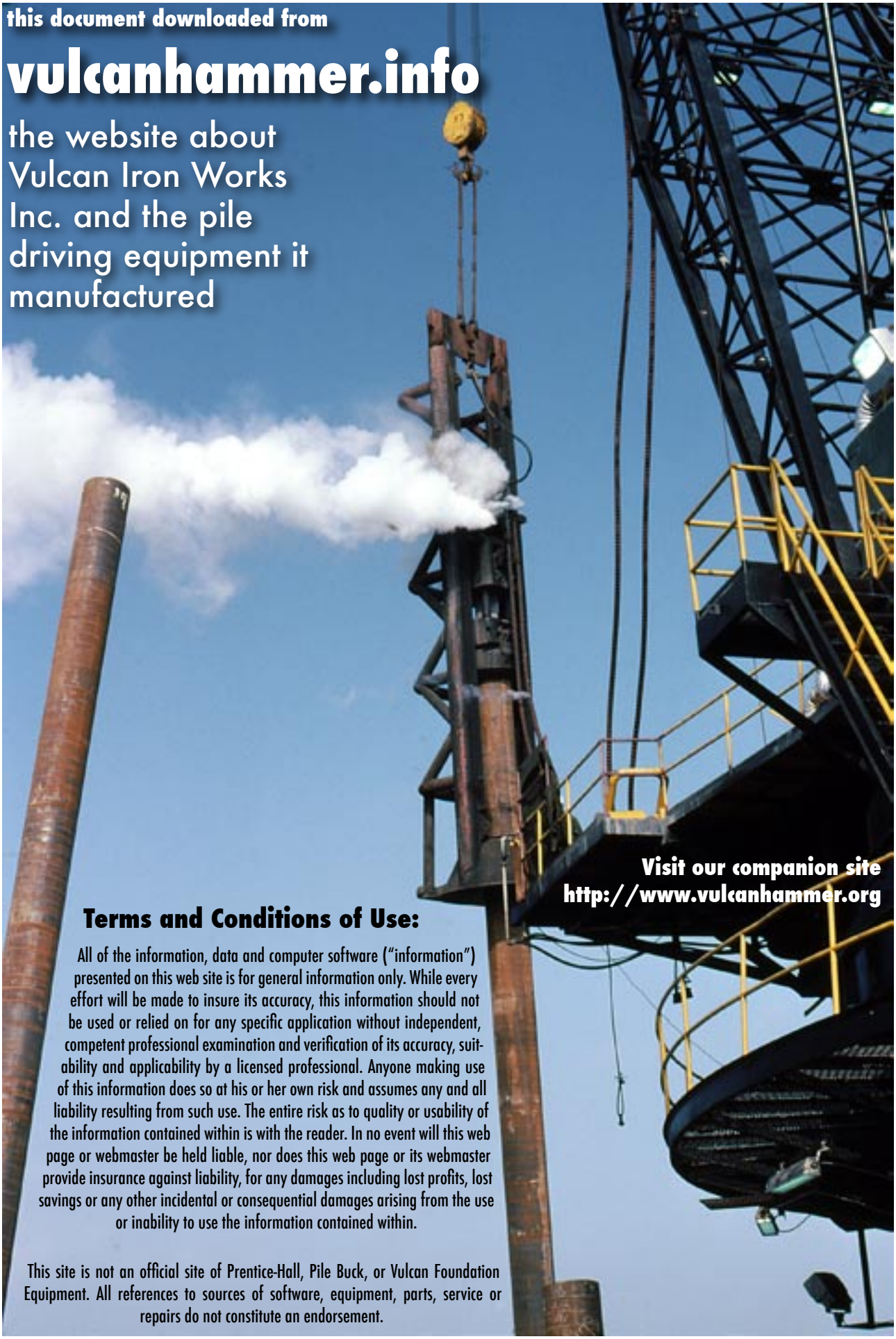

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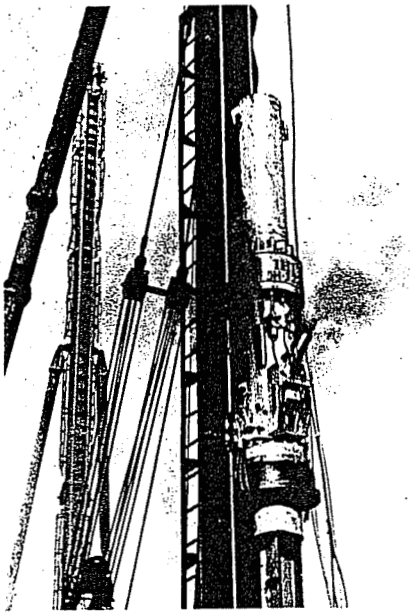
IHI

INSTRUCTION MANUAL FOR DIESEL PILE HAMMER MODEL IDH-J22



Ishikawajima-Harima Heavy Industries Co., Ltd.
Mass-Produced Macineny Division
TOKYO JAPAN
1970. 7

PRECAUTIONS FOR PILE HAMMER OPERATION

The following items should be strictly observed when operating the pile hammer. Extreme care should be taken as negligence will not only damage the hammer itself, but also inpure the operators and nearby people, furthermore damage the surrounding buildings.

1. MAX. PENETRATING RATE PER BLOW

   When the ground is soft and low in resistance, or the pile diameter is small, let the banner free-fall several times, before starting normal operation. In other words, pull down the rope of the fuel stopping lever and left to cut the fuel supply, and let the upper piston fall freely.

   The wire rope connecting the lower part of the hammer and the pile cap will break if the pile penetrates more than 20 cm per blow. The lower cylinder, outer end ring and inner end ring will bend or break if the pile penetrates more than 27 cm per blow. In order to prevent such serious damage, conduct free-falling without a fuel supply or operate the hammer with little fuel supply.

2. ROPE SPEED OF THE TRIPPING DEVICE

   Do not run the rope of the tripping device faster than 12 m per minute.
   Especially when setting the hammer on the pile, stop the winch temporarily and set the pile. Excessive rope speed will damage the tripping device resulting in falling of the hammer, and careless setting of the hammer will cause a wild blow.

3. LIMITATION OF THE HAMMER OPERATION

   When the upper piston jumps up to 1.8 m and the penetration of the pile is below 0.5 mm per one blow (below 5 mm per 10 blows), stop the hammer operation. (When the upper piston jumps above 2.6 m, lower the volume of the fuel intake.) Continuous operation under these circumstances will cause severe damage to the piston and cylinder.

4. HAMMER GUIDE AND LEAD

   Maximum clearance between the hammer guide and the lead is 7 mm on both sides (3.5 mm on one side). The clearance above 7 mm will result in accidental falling of the hammer or breakage of the unit. It is very dangerous to use the lead, bent, worn, or improperly jointed, because such a lead will only cause damage.

5. PILE SET-UP

   When setting the pile, be careful not to let the pile come in contact with the hammer. Set the hammer center so that it comes in line with the pile center. Otherwise, the pile will sway causing damage or an accident.

6. HOISTING OF THE HAMMER

   When the hammer is hoisted by the tripping device, make sure that the locking device is in the proper position and hold down the hooks, and the hooks carry the hoisting seat of the upper cylinder before hoisting. Do not go under the hammer or put your hands between the hammer and the pile. If necessary, insert a wood block.

7. DAILY INSPECTION AND CLEANING

Start the operation after making sure that all the bolts and nuts are tight, and fastened with safety wire. Be sure to replace the bolts if the threads are abraded. If the worn bolts are left as they are, they may cause damage. Always keep clean the conbustion chamber, the concave surface of the upper and lower cylinders.

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Identification of Pile

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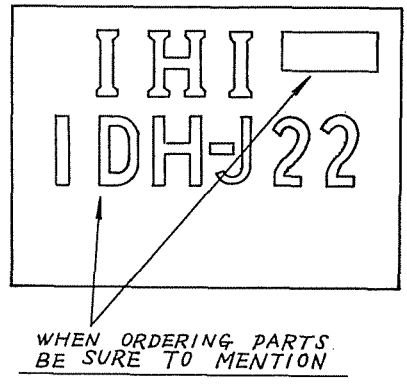
PREFACE

The care exercised in the operation and maintenance of IHI Diesel Pile Hammers will extend their useful life and insure highly satisfactory and dependable service. To those responsible for the operation and maintenance of the pile hammer, this manual contains suggestions on everyday operation and care as well as periodical lubrication and maintenance instructions.

Identification of Pile Hammer

A plate is attached to the front of the unit showing the model and serial number. When ordering parts for the hammer, or when carrying on correspondence, be sure to mention the model and serial number of the hammer.



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Chapter 1 INTRODUCTION

1-1 Outline

For the conventional impact atomization type diesel pile hammers, the fuel pump is operated when the upper piston falls, the fuel is injected and stays on the top surface of the lower piston. When the upper piston strikes the lower piston, the fuel disperses being atomized, mixes with the high temperature and high pressure air which is compressed by the upper piston, and is ignited. Therefore, when the temperature of the machine parts (especially of the top surface of the lower piston) rises after running for some time, the fuel supplied onto the top surface of the lower piston is gasified and ignited before the lower piston is struck. So that, the falling speed of the upper piston is reduced and the striking force is lowered. This was the weak point of the conventional diesel pile hammers.

On the other hand, for this nozzle atomization type diesel pile hammer, the following combustion system is adopted. That is, the fuel pump is operated by utilizing the pressure of compressed air in the cylinder, which becomes high when the upper piston falls, and the fuel is injected by the nozzle, being atomized, into the compressed air of high temperature and high pressure just after the upper piston strikes the lower piston.

Therefore, the fuel can be ignited without fail even when the ground is weak and the upper piston cannot strike the lower piston strongly because the pile is driven into the ground only by the pneumatic pressure of the air which is compressed by the falling upper piston. So, continuous striking performance is high and the striking force is not lowered by preignition even after continuous operation for a long time. Besides, as this pile hammer is of air-cooled type, handling and maintenance are quite easy, and a trouble such as freezing of cooling water in winter is completely eliminated.

1-2 Specifications

Model		1DH–J22
Overall length	mm	4,251
Total weight	kg	4,910
Upper piston weight	kg	2,200
Number of blow	blow/min.	40 – 70
Energy out-put per blow	kg·m	5,500
Fuel consumption (Kerosene or Heavy Oil)	*l*/hr.	14
Lubricating oil consumption	*l*/hr.	15
Fuel tank capacity	*l*	50
Capacity of lubricating oil basin	*l*	7

1-3 Structure

Model 1DH–J22 diesel pile hammer consists of the upper cylinder, lower cylinder, upper piston which moves up and down in the cylinder, lower piston which is housed in the lower cylinder, fuel pump driving device, Bosch type fuel pump, nozzles, fuel stopping device, fuel tank around the top of the lower cylinder, fuel filter, starting device, etc.

The upper part of the upper piston forms a lubricating oil basin, and oil is sprinkled out through the small oil holes little by little during operation and lubricates the inner surface of the cylinders.

The fuel pump and the pump driving device are mounted in the middle in front of the lower cylinder and are driven by the pneumatic force of the air which is compressed by falling of the upper piston. Thus, they inject fuel into the combustion chamber through the nozzles by atomizing it.

The starting device moves vertically along the lead pipes of the piling frame. This is used for lifting the upper piston when starting the pile hammer and also for lifting the pile hammer itself at the time of erecting the pile.

1-4 Theory of Operation (refer to F. 1-2, F.2-8)

(1) Starting (Free Falling)

When the starting device is hoisted up, the upper piston moves upward being hooked by the pawl of the starting device. When the upper piston reaches the specified height, the tripping mechanism works and the upper piston falls automatically.

(2) Compression and Striking

The upper piston, which falls, closes the air intake and exhaust ports of the cylinder, keeps on falling by compressing the air in the cylinder, strikes the lower piston at last and thus drives the pile into the ground by the impact force caused at that time.

(3) Combustion

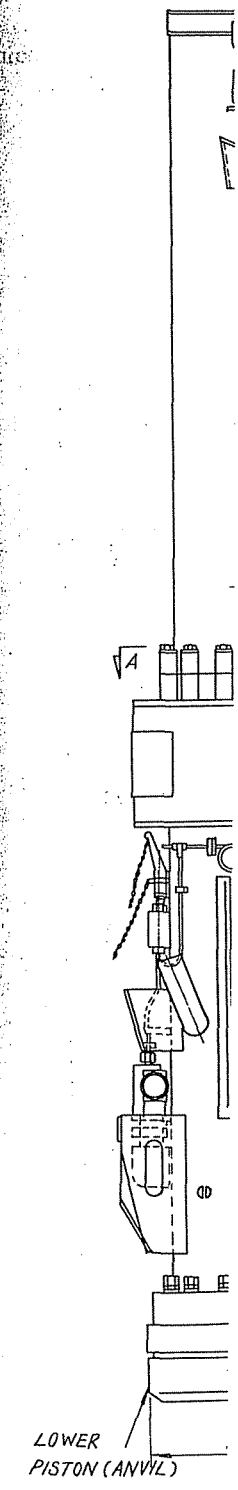
By the pneumatic pressure at the time when the upper piston strikes the lower piston, the fuel pump works and injects fuel into the cylinder through the two nozzles. Combustion begins at the same time as fuel injection, and the pressure in the cylinder rises. This combustion pressure works upon the fuel pump driving device and keeps it injecting the fuel. Besides, it also works upon the upper piston to make it jump up and presses the lower piston to promote penetration of the pile.

(4) Exausting

When the upper piston moves up, the exhaust ports open, and the combustion gas in the cylinder expands and is exhausted.

(5) Suction of Air

When the upper piston further moves up passing the exhaust ports, fresh air is sucked into the cylinder through the exhaust ports, and thus the combustion gas is replaced with fresh air.



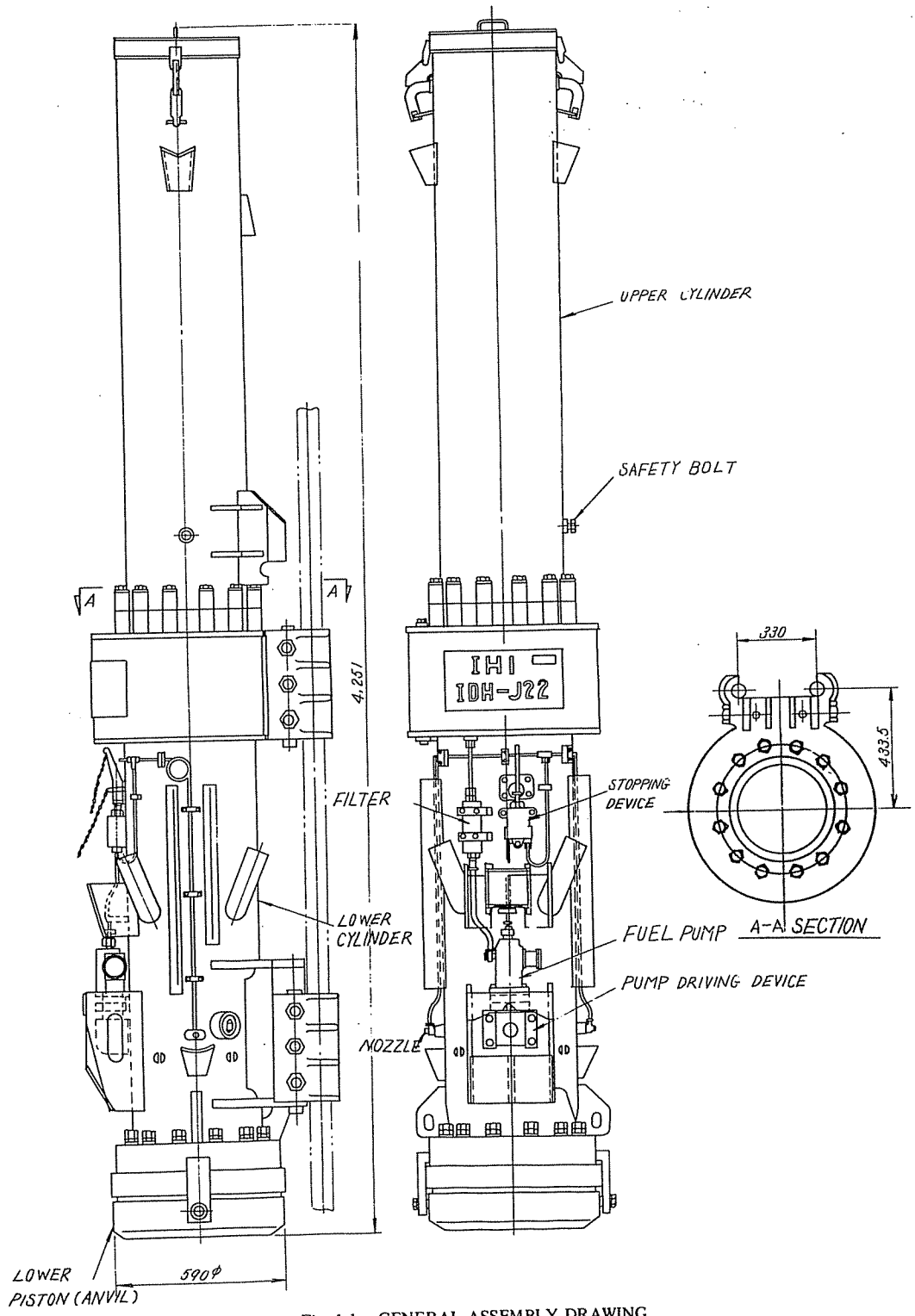


Fig. 1-1 GENERAL ASSEMBLY DRAWING

The pump driving piston and the fuel pump return to the original position because of decrease of pressure in the cylinder, and a new batch of fuel enters into the fuel pump from the fuel tank.

These processes are finished before the upper piston reackes the upper dead point. Then, the upper piston falls again freely. Thus, every step of the operation is automatically repeated continuously.

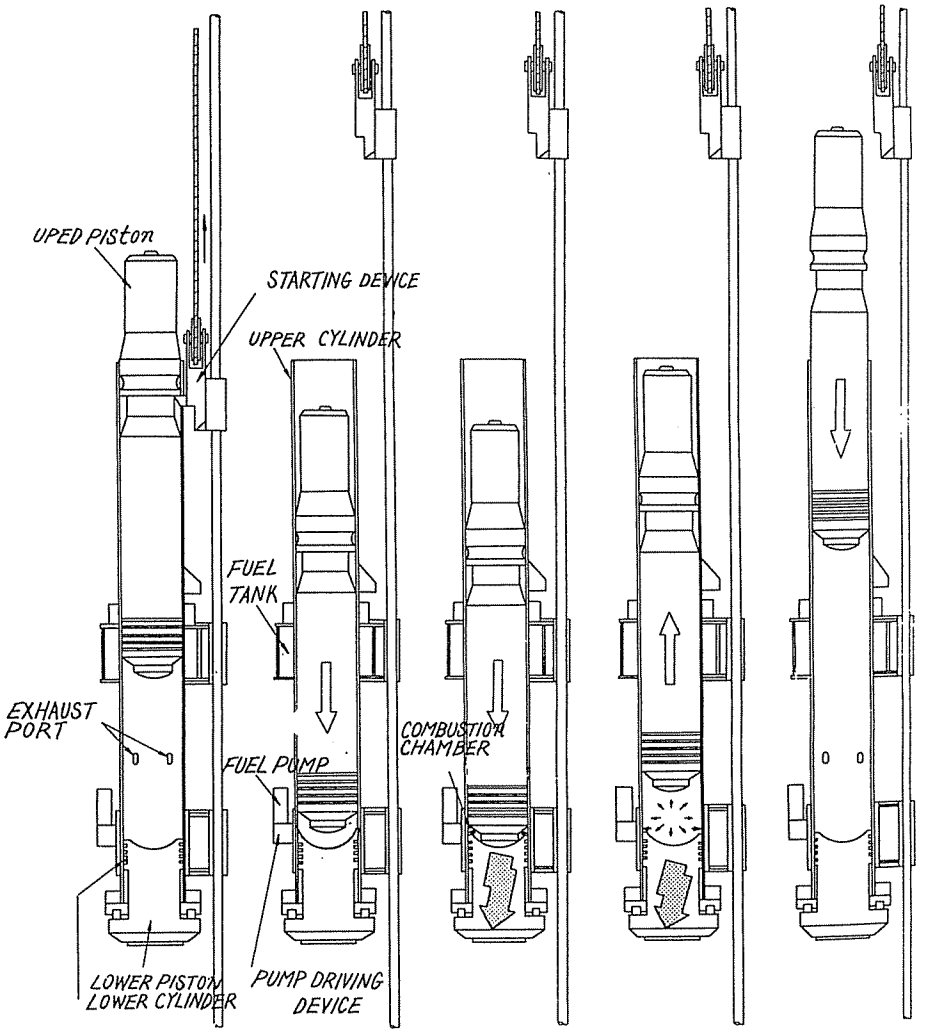


Fig. 1-2

Chapter

2-1 Hammer Body

(1) Upper Pisto

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top)to apply the
space around the
serves as the com

(2) Lower Pist

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lower cylinder.
a concave spheri
striking surface

(3) Upper Cyl

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upper piston fro
side, a pawl gro
of the starting d
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seat is fixed by
by the starting
cams for autom
piston at the ti
upper and lowe
centered by the

(4) Lower Cy

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cylinder

Chapter 2 STRUCTURE AND FUNCTION OF EVERY PARTS

2-1 Hammer Body (see F. 2-1)

(1) Upper Piston (Ram)

The upper piston is provided with 6 piston rings and a catch ring. A catch ring is for preventing the upper piston from jumping out of the cylinder in case the combustion force is unusually strong and the piston jumps up abnormally. The top of the piston is provided with the lubricating oil basin. By the oscillation of lubricating oil during running, it is sprinkled out through the small oil holes to lubricate the piston. Besides, a flange is cut near the middle of the piston(somewhat toward the top)to apply the pawl at the time of starting. The space around the striking part at the bottom serves as the combustion chamber.

(2) Lower Piston (Anvil)

The lower piston is provided with 5 piston rings. Between the top and the second piston rings, a groove is provided to hold the super-heated steam cylinder oil for lubricating the lower cylinder. The top of the lower piston has a concave spherical surface which watches the striking surface of the upper piston.

(3) Upper Cylinder

The upper cylinder is provided with a groove for fixing the catch ring which is to prevent the upper piston from jumping out. On the leader side, a pawl groove is cut through which the pawl of the starting device travels.
On the outside of the upper cylinder, a lifting hook seat is fixed by welding for lifting the hammer body by the starting device. Besides, the upper and lower cams for automatically lifting and dropping the upper piston at the time of starting are also welded. The upper and lower cylinders are combined and centered by the spigot and socket joint.

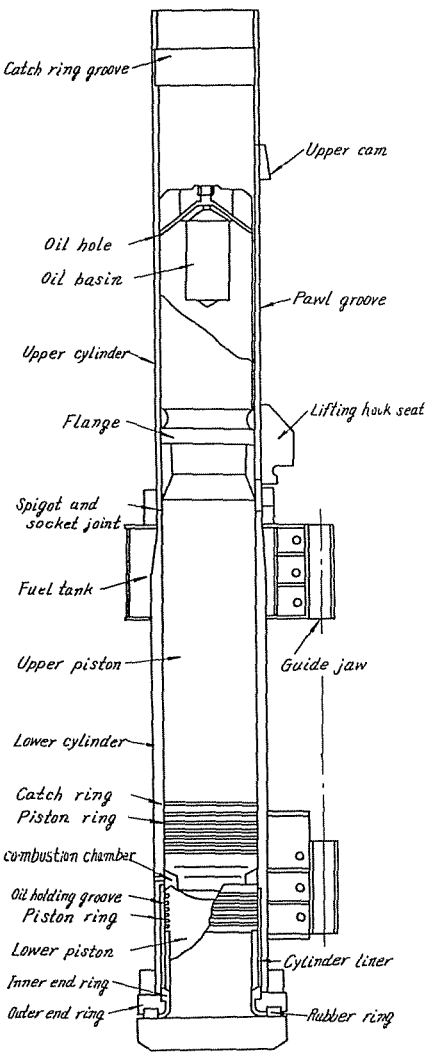

Fig. 2-1

(4) Lower Cylinder

In the lower part of the lower cylinder, a cylinder liner for the lower piston is inserted. To prevent the lower piston from falling off, an inner end ring of split type and an outer end ring to fix the inner end ring are provided. Besides, a rubber ring is fitted to the outer end ring in order to absorb the shock between the lower piston and the lower cylinder

On the outside near the top of the lower cylinder, a fuel tank is provided. On the outer surface of the lower cylinder, guide jaw mounting seat for sliding the pile hammer body and mounting seats for various component parts of the firing mechanism are fixed.

On the periphery of the lower cylinder, four decompression holes are provided so that the combustion gass will escape when abnormal continuous striking occurs and thus to prevent the lower piston from striking the inner end ring and to avoide damage.

2-2 Starting Device

(1) Lifting of Hammer Body (see F. 2-2, F. 2-3)

When the locking device is not pushing the left hook as shown in F. 2-2, the right and left hooks are open because of the torsion springs which are provided to the shafts of both hooks. However, when the lever is pulled as shown in F. 2-3, the locking device pushes the left hook and the right hook is moved by the connecting rod. Thus, the lifting hook seat is held by the right and left hooks and the hammer body is lifted up. As a ratchet gearing is provided to the locking device, the lever returns to the original position being pulled by the returning rubber when the rope is released, but the position of the locking device does not change. When the rope is pulled again, the locking device turns and the left hook is not pushed. Thus the operation is repeated by pulling and releasing one rope.

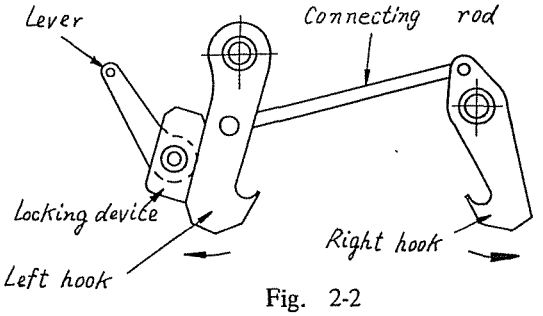

Fig. 2-2

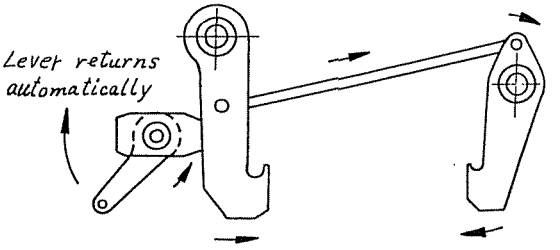

Fig. 2-3

(2) Lifting of Upper Piston (see F. 2-4, F. 2-5)

When the starting device is moved downward, the tripping lever touches the lower cam of the upper cylinder and moves upward (arrowhead a). When the center A for fixing the fishplate to the tripping cam comes to the right side of the line which is connecting the center B for fixing the pawl and fishplate and the center C of the tripping cam, the starting device is pulled up and the flange of the upper piston is hooked to the tip of the pawl. Thus, a force is applied in the direction of the arrowhead b , the center A is pushed in the arrowhead direction c , the fishplate contacts the stopping bolt, and therefore, the pawl does not move downward and the upper piston is lifted as it is.

When the starting device is lifted up as it is, the tripping lever touches the upper cam of the upper cylinder as show in F. 2-5, and moves downward (arrowhead d). So, the center A comes to the left side of the line which connects the center B and the center C. Then, because of the force applied to the tip of the pawl in the arrowhead direction e , the center A is pushed in the arrowhead direction f , the pawl moves downward being released from the flange of the upper piston. Thus, the upper piston falls down automatically.

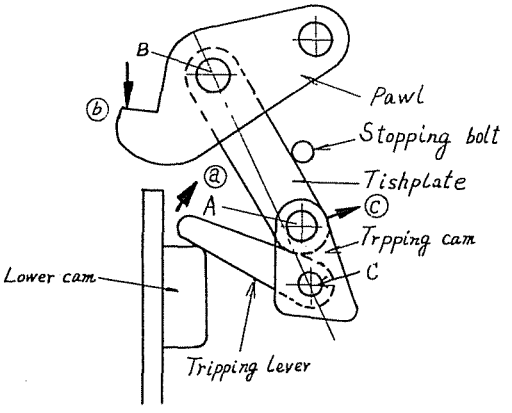

Fig. 2-4

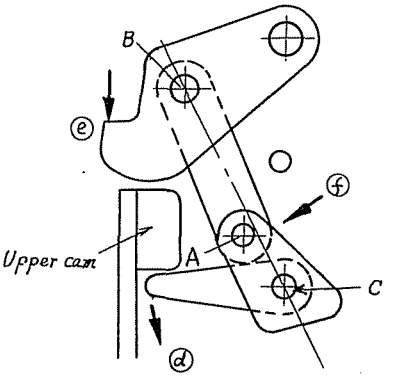

Fig. 2-5

If the starting device is not fully moved down before lifting the upper piston or when the tripping lever contacts something else and the center A comes to the left side of the line which is connecting the center B and C, the pawl moves downward and is released from the flange of the upper piston. Therefore, it is impossible to lift the upper piston.

(3) Safety Bar for Preventing Accidental Combustion (see F. 2-6)

The right hook cam is bolted to the right hook as shown in F. 2-6, and a safety cam for preventing an accidental explosion is fixed to the end of the tripping lever shaft by a key. When the right hook holds the lifting hook seat for lifting the hammer body (arrowhead a), the right hook cam moves clockwise to push up the safety cam (arrowhead b) and moves the tripping cam counter-clockwise (arrowhead c). So, the center A is forcibly fixed on the left side of the line between the centers B and C as shown in F. 2-5. Therefore, when the starting device is lifted, the pawl is released from the upper piston flange and the upper piston is placed directly on the lower piston when starting device is lifting the hammer body. Thus, the accidental explosion is completely eliminated when the hammer body is placed on the pile.

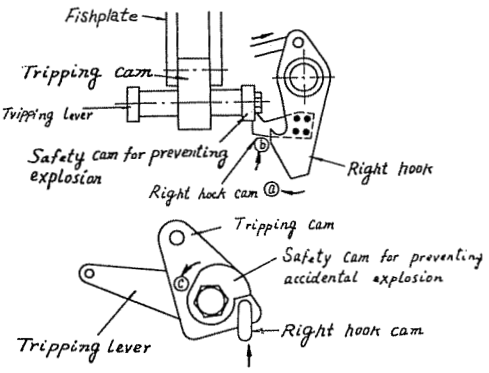

Fig. 2-6

2-3 Firing Mechanism

(1) Fuel Piping Diagram

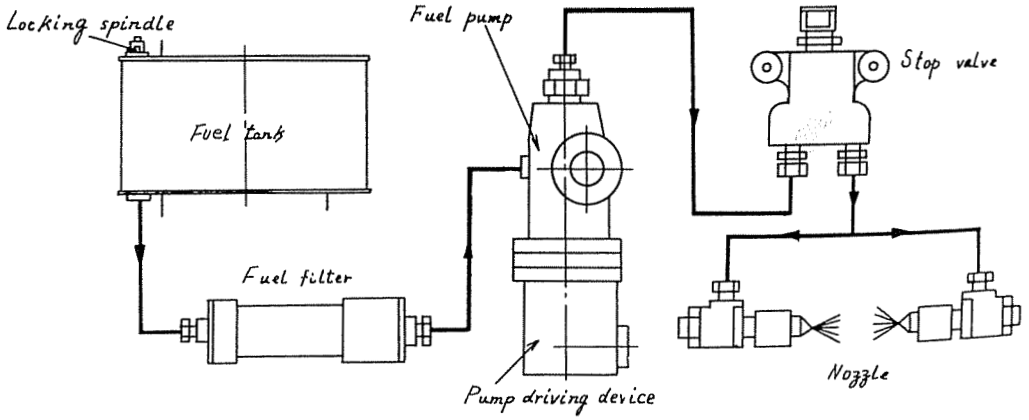

Fig. 2-7

(2) Fuel Pump Dr

ⓐ Fuel Pump

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driving piston
For sealing the
the piston is fi
sprinkled to lu
pump.

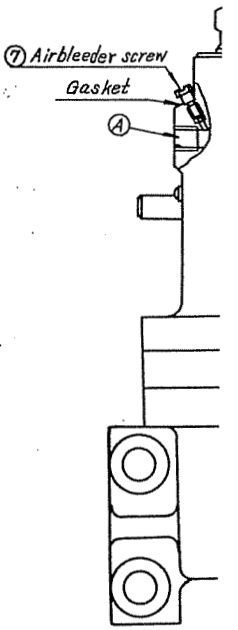

Fig. 2-8 Section

(2) Fuel Pump Driving Device and Fuel Pump

ⓐ Fuel Pump Driving Device

Structure of this device is as shown in F. 2-8, and it is assembled into the lower part of the fuel pump to form an integrated structure. When the pressure of the air increases and exceeds the force of the plunger spring ① of the fuel pump, the pump driving piston ② is pushed up and thus operates the plunger ③ of the fuel pump. For sealing the compressed air, piston rings ④ are provided. The concave part of the piston is filled with lubricating oil. When the piston moves up and down, oil is sprinkled to lubricate the inner wall of the cylinder ⑤ and the inside of the fuel pump.

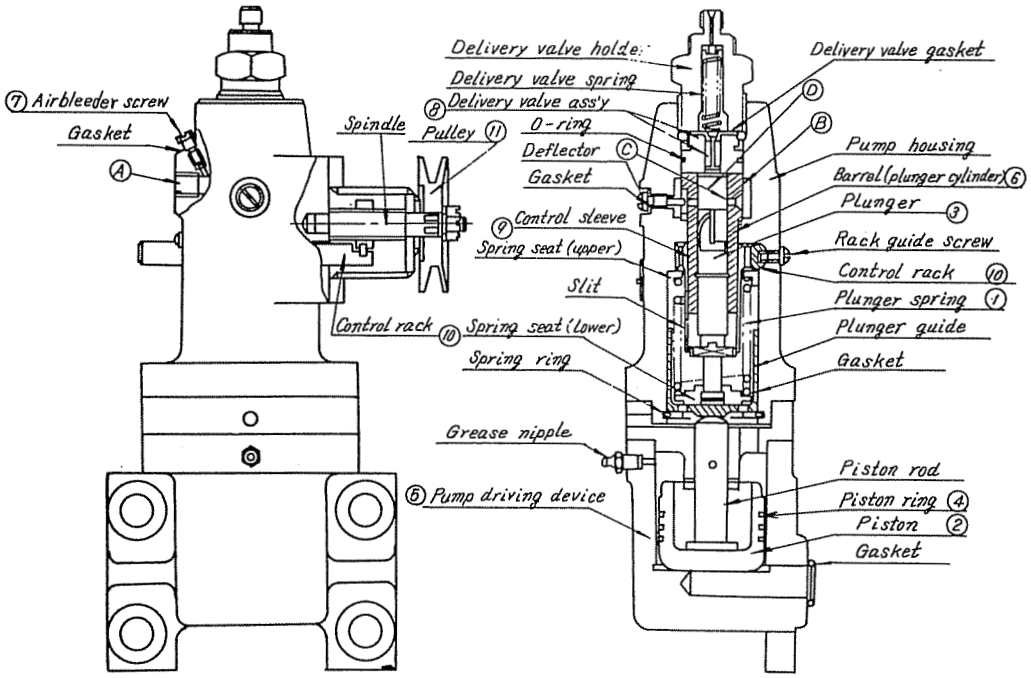

Fig. 2-8 Sectional View of Fuel Pump, Fuel Pump Driving Device and Fuel Regulating Device

ⓑ Fuel Pump (see F. 2-8)

Structure of the fuel pump is as shown in F. 2-8, and it is of Bosch type ones.

Fuel which is fed from the fuel tank through the fuel filter enters into the suction chamber Ⓑ around the plunger cylinder ⑥ through the intake port Ⓐ. For air bleeding on the inlet side, loosen the air bleeder screw ⑦ above the inlet port Ⓐ . Fuel which has entered into the suction chamber Ⓑ around the plunger cylinder ⑥ goes into the chamber Ⓓ at the top of the plunger through the port Ⓒ of the plunger cylinder. As the plunger ③ is pushed up by the pump driving piston, the fuel in the top chamber Ⓓ is forced into the nozzles by pushing the delivery valve (check valve) ⑧ open.

The plunger ③ is provided with a special shape of groove which coincides with the port Ⓒ of the plunger cylinder ⑥ . The coinciding amount of the groove and port can be varied by rotating the plunger.

If the plunger is rotated to such position that the groove and the port Ⓒ do not coincide at all, the fuel in the chamber Ⓓ at the top of the plunger is forced out to the two nozzles as a whole (about 5cc). If the plunger is at a position that the groove coincides with the port Ⓒ , a part of the fuel is returned from the chamber at the top of the plunger to the suction chamber Ⓑ through the port Ⓒ when the plunger is pushed up. The amount of returning fuel is in proportion to the coinciding amount of the groove and the port Ⓒ , and thus the amount of fuel which is pushed out to the nozzles is adjusted. It is also possible to adjust the rotating angle of the plunger so that the whole fuel is returned to the suction chamber and make the amount of fuel pushed out to the nozzles zero.

The plunger ③ is meshing with the control sleeve ⑨ . On the outer surface of the control sleeve ⑨ , gear teeth (pinion) are cut, and the pinion is meshing with the control rack ⑩ . The plunger is rotated by moving the control rack ⑩ rightward or leftward, and thus the coinciding amount of the plunger groove and port Ⓒ is adjusted.

The control rack is connected to the fuel regulating device which is mounted on the outside of the fuel pump. The control rack ⑩ can be moved rightward and leftward by rotating the pully ⑪ . When the pully is turned clockwise, the fuel volume increases, and it decreases when turned counterclockwise.

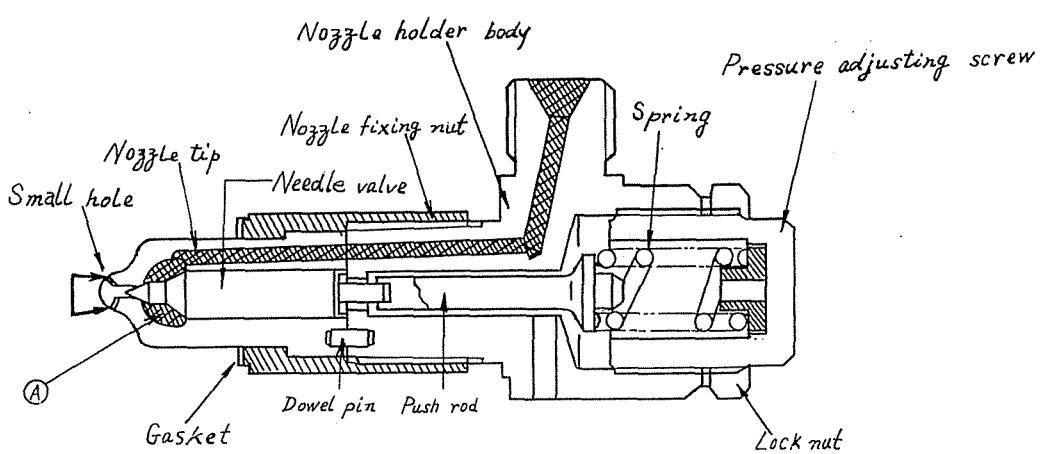

Fig. 2-9 Nozzle

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the needle valve opens
end of the nozzle tip

(4) Fuel Stopping D

Structure of the
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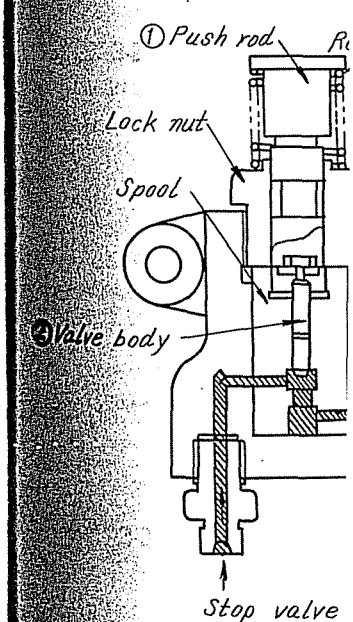
by the spring ⑤ beco
without returning to t
hammer, pull the rope
spring and returns to
from the fuel pump to



(5) Fuel Filter (see

Structure of th
in F. 2-11. It consis
and secondary filter.
of cylindrical type a
of 100 mesh. The s
corrugated barrel typ

Structure of the nozzle is as shown in F. 2-9. The fuel which is pushed out from the fuel pump enters into the chamber Ⓐ in the nozzle tip through the fuel passage. When the pressure of the fuel becomes the same as the spring-loaded pressure of 100 kg/cm^2, the needle valve opens, and the fuel is injected into the cylinder through two holes at the end of the nozzle tip being atomized in the fan shape.

(4) Fuel Stopping Device (see F. 2-10)

Structure of the fuel stopping device is as shown in F. 2-10. This device is provided between the fuel pump and nozzles and is to stop the hammer by shutting off the fuel passage from the fuel pump to the nozzles by pushing down the push rod ① and valve body ② by pulling the stopping lever ③ When the stopping lever is pulled, the pawl ④ which was pulled by the spring ⑤ becomes horizontal, and it keeps on pushing the push rod and valve body without returning to the original position, and thus fuel is kept stopped. To restart the hammer, pull the rope of the pawl. Then, the stopping lever is pushed back by the return spring and returns to the original position, the valve body is pulled up, and the passage from the fuel pump to the nozzles is opened.

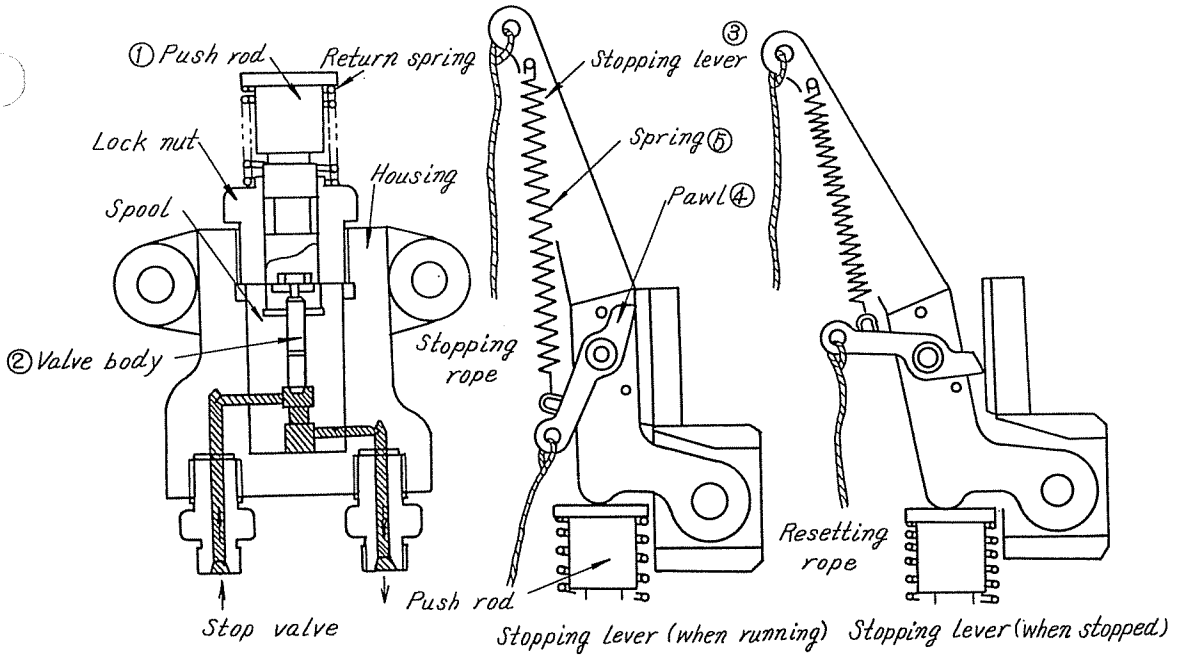


Fig. 2-10 Fuel Stopping Device

(5) Fuel Filter (see F. 2-11)

Structure of the fuel filter is as shown in F. 2-11. It consists of the primary filter and secondary filter. The primary filter is of cylindrical type and is made of wire netting of 100 mesh. The secondary filter is of corrugated barrel type and is made of layers

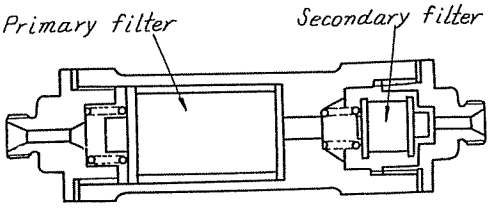


Fig. 2-11 Fuel Filter

of wire nettings. The filtering accuracy of element is 20 microns.

(6) Fuel Tank (see F. 2-12)

The fuel tank is provided near the top of the lower cylinder. The locking spindle (fuel cock) is provided above the fuel outlet port of the fuel tank. On the locking spindle seat, shallow slot and deep slot are cut. Before starting the pile hammer, be sure to pull up the locking spindle and engage it to the shallow slot. Thus, the rubber valve at the bottom of the fuel tank opens and the fuel flows to the fuel pump.

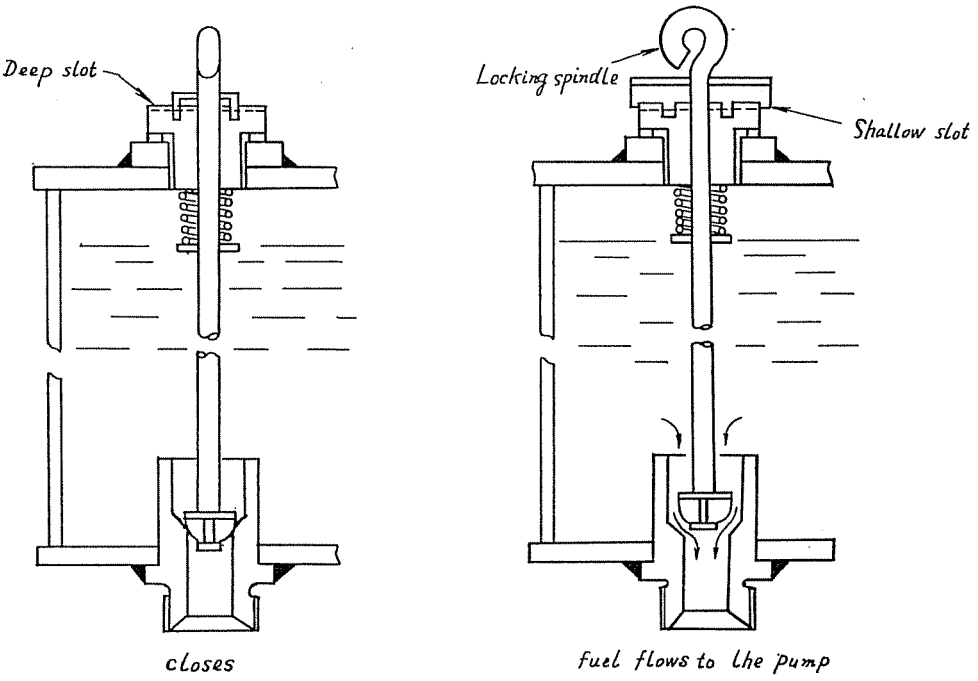


Fig. 2-12 Fuel Tank

3-1 Upper Piston Lu

Applicable Season / Manufacturer
Shell Oil
Mobil Oil Co.
ESSO Oil
Gurf Oil Corp.

3-2 Lower Piston L

Applicable Seasor / Manufacturer
Shell Oil
Mobil Oil
ESSO Oil
Gurf Oil Corp.

3-3 Lubricating In

(1) Upper P

(2) Lower I

(3) Fuel Pu

Chapter 3 LUBRICATING OIL, FUEL

3-1 Upper Piston Lubricating Oil (Motor Oil SAE-40 – 50)

Applicable Season / Manufacturer	o Spring o Autumn o Winter	o Summer o On the operation where it takes over one hour to drive one pile.	o Severe cold region (-10 – -20°C)
Shell Oil	Shell Rotell Oil No.40	Shell Rotell Oil No.50	
Mobil Oil Co.	Delvac Oil 940	Delvac Oil 950	Delvac Oil 910
ESSO Oil	Essolub HD-40	Essolub HD-50	Essolub HD-20
Gurf Oil Corp.	Gulf Dieselub HD-40	Gulf Dieselub HD-50	Gulf Dieselub HD-30

3-2 Lower Piston Lubricating Oil (Superheated Cylinder Oil)

Applicable Season / Manufacturer	o Spring o Autumn o Winter	o Summer o On the operation where it takes over one hour to drive one pile.
Shell Oil	Shell Valvata Oil No. 79	Shell Valvata Oil No. 85
Mobil Oil	Mobil 600W Super Cylinder Oil	Mobil 600 W Super Cylinder Oil
ESSO Oil	Sylesso 300	Sylesso 300
Gurf Oil Corp.	Gulf M Cylinder Oil	Gulf M Cylinder Oil

3-3 Lubricating Instructions

(1) Upper Piston ..... Supply upper piston lubricating oil (required quantity is 7 *l*) every day before starting. If lubricating oil stops to come out from the discharge ports of the upper piston during running, stop the pile hammer at once and supply lubricating oil.

(2) Lower Piston ..... At every 20 minutes of net running time or after driving every pile, supply lower piston lubricating oil to 4 grease nipples by a grease pump by 10 strokes per every nipple.

(3) Fuel Pump Driving Cylinder

At every 20 minutes of net running time or after driving every pile, supply lower piston lubricating oil to 4 grease nipples by a grease pump by 10 strokes per every nipple.

(4)	Inspection Plug	Every day before starting the hammer, pull out the inspection plug, smear inspection plug lubricant (Molibdenum Disulfide or Graphite) and screw the plug in.
(5)	Starting Device	At least at every one week, supply several drops each of upper piston lubricating oil by a hand oiler to every sliding part and moving part of the starting device. Besides, to the grease nipple of the pulley, supply mineral grease at every one week by a grease pump by 10 strokes.
(6)	Stopping Device	At least at every one week, supply several drops each of upper piston lubricating oil by a hand oiler to every sliding part of the stopping lever and push rod.
(7)	Lead Pipe	Check every day before starting the hammer and smear mineral grease to those portions where grease is becoming short.

3-4 Fuel Oil

(1) For all the year round, it is recommended to use light oil (light oil for diesel engines, light oil of JIS No. 1, 2 and 3, etc. Any kind or brand will do.)

(2) It is also possible to use heavy oil A or heavy oil for diesel engines.

(3) It is also possible to use kerosine (any kind or brand).
However, when using kerosine, mix about 20% of upper piston lubricating oil to improve the lubricating effect.

Notes: 1) Always use clean fuel oil, and keep fuel oil free from mixing of dust, rain, etc.

2) When supplying fuel oil, be sure to clean the oil inlet beforehand to prevent dust or foreign matters from entering.

4-1 Fixing Procedure

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(3) Bind anothe
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(4) Hoist the h
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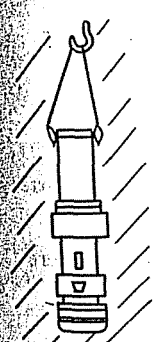


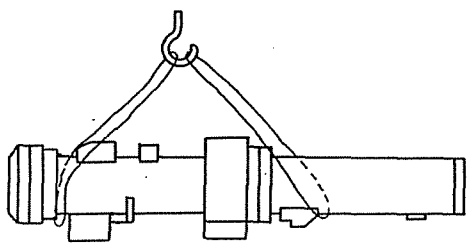
Front view Sic

(1) Hook the wire to the hook

Chapter 4 OPERATION AND HANDLING

4-1 Fixing Procedure of the Diesel Pile Hammer

(1) Unload the hammer around the lead from the truck. When unloading the hammer, sling the wire ropes (two ropes) as shown in F. 4-1. And when hoisting the hammer, check the center of the gravity by hoisting slowly at first.
The specified thickness of the rope is over 14mm.



Sling the wire rope around the hook groove

Fig. 4-1

(2) Pass the wire around the pully of the starting device (see F. 4-2), and fix it to the lower end of the lead and hoist the assembly about 5m.

The specified thickness of the wire is over 20 mm for the one-pully device.

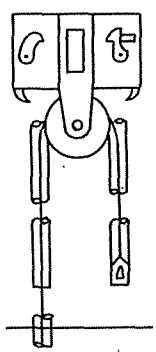
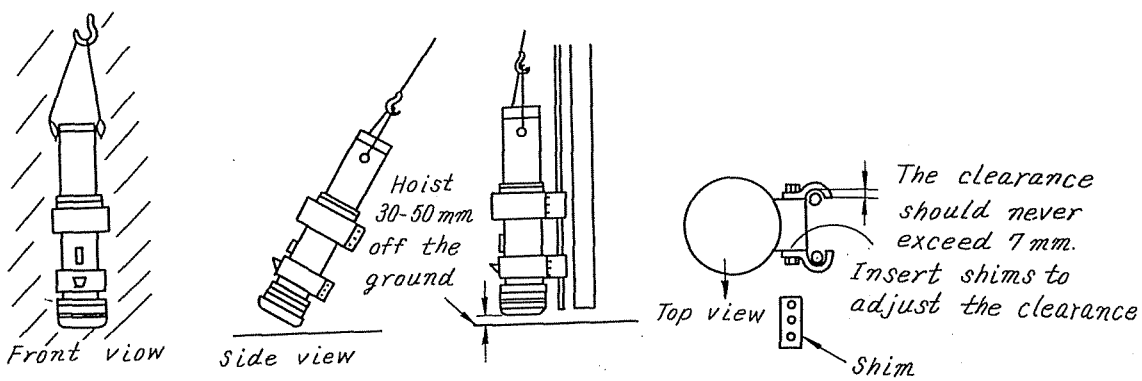


Fig. 4-2

(3) Bind another wire rope to the hook of the upper cylinder and pull the hammer near the lead.

(4) Hoist the hammer about 30 mm from the ground and fix both the guide jaws on one side of the lower cylinder, then attach the hammer unit to the lead. Next, fix the guide jaws on the other side of the lower cylinder and tighten them securely. The clearance between the lead and the guide jaw should never exceed 7 mm. Excessive clearance is dangerous as the guide jaw may come off the lead. The clearance can be adjusted by inserting shims.



(1) Hook the wire to the hook (2) (3) Mate the guide jaw and the lead. First fix the one guide jaw and then the other. (4) Guide jaw adjustment

Fig. 4-3

(5) Fixing the protective wire rope

Run the protective wire rope through the hook on the lower part of the cylinder and hook of the pile cap.
Provide sufficient slank in the wire so that the lower piston can slide down 15 – 20 cm.
The specified wire thickness is over 20 mm.

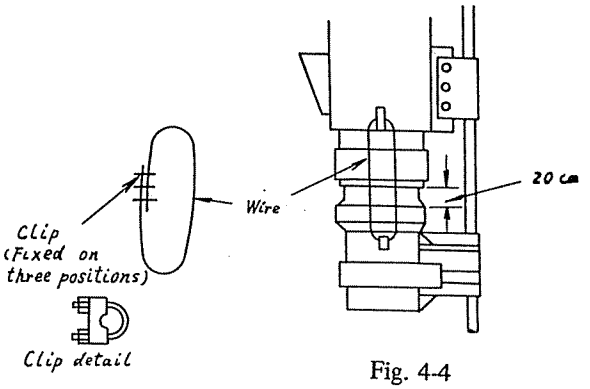


Fig. 4-4

4-2 Inspection and Lubrication before Starting the Operation

(1) Remove the following shipping fixtures.

Upper cylinder protecting cap
Upper cylinder protecting plate
Lower cylinder exhaust plug
Upper piston safety bolt
Lower piston safety fixture

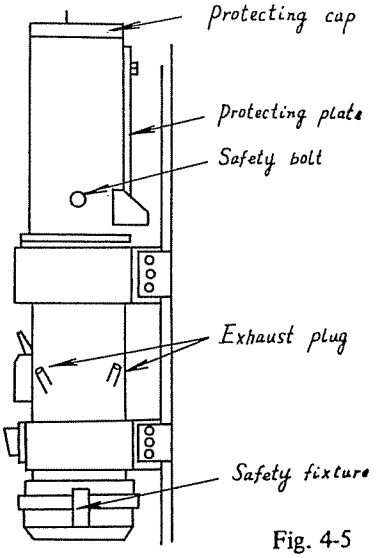


Fig. 4-5

(2) Points to inspect and tighten daily before starting operation.

(a) Conical hexagon nuts on the guide jaw of the lower cylinder.
(b) Fuel pump fixing nuts.
(c) Conical hexagon nuts fixing the lower cylinder and the end ring.
(d) Bolts connecting the upper cylinder and the lower cylinder.
(e) Bolts and nuts for the guide gib of the starting device.

(3) Fill fuel daily before starting operation.

The fuel tank capacity is about 50 *l*.

(4) Loosen the drain plug at the bottom of the fuel tank and drain the moisture in the fuel tank once a week.

(5) Fill the upper piston oil basin with lubricating oil in the following procedure.

(a) Move down the tripping device slowly so that the pawl engage the ring groove of the upper piston.

(b) Hoist the upper piston by the tripping device so that it protrudes about 2cm from the upper cylinder.

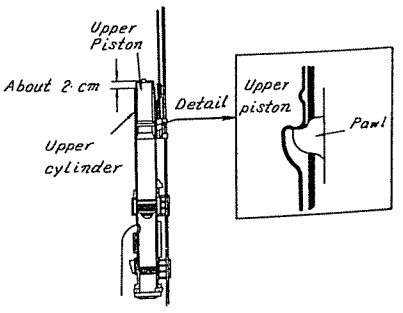


Fig. 4-6

NOTE 1 Do no
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NOTE 2 When
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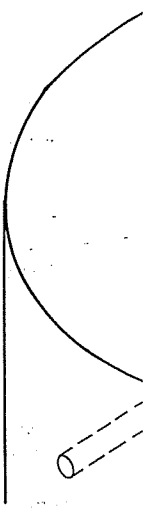
Oiler plug



(d) For the init
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(7) Supply superhea
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the grease nipple using
During operation, supp

NOTE 1 Do not hoist the upper piston excessively, or the upper piston supported by the pawl of the tripping device may be disengaged from the pawl and fall down.

NOTE 2 When hoisting the upper piston, pull the rope of the fuel stop lever so that fuel may not be discharged.

(c) Remove the oiler plug on top of the upper piston and fill the lubricating oil from the oiler hole, then, replace the oiler plug.

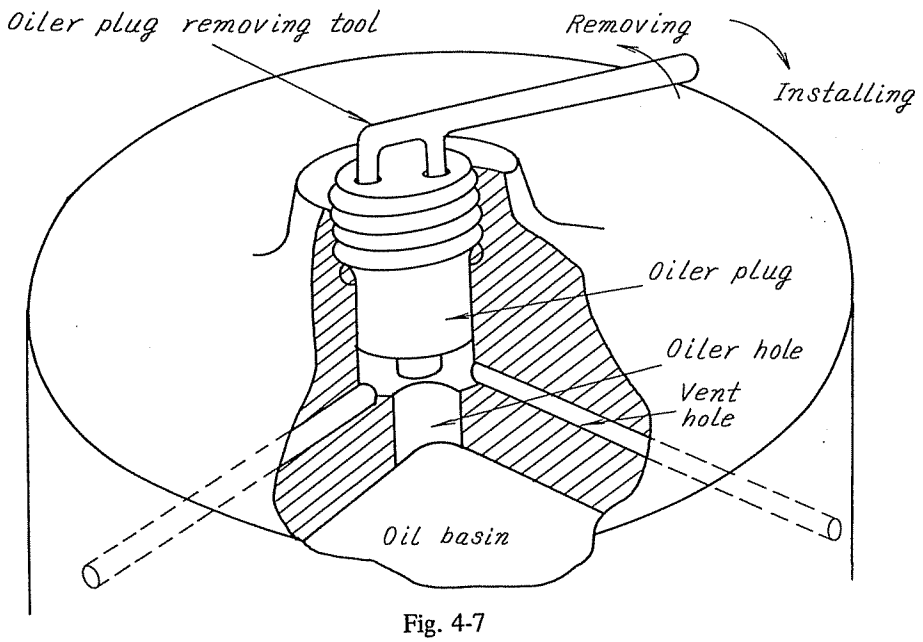


Fig. 4-7

(d) For the initial break-in operation, pour 0.5 *l* of motor oil around the upper piston from the top of the upper cylinder and actuate the upper piston up and down by the tripping device.
(Perform this operation just before pile set-up)

(6) Supply the grease to the lower piston from the 4 grease nipples using the grease pump. Supply the grease every 20 minutes during the piling operation (while greasing, care should be taken not to allow the grease to go into the hollow of the lower piston.)

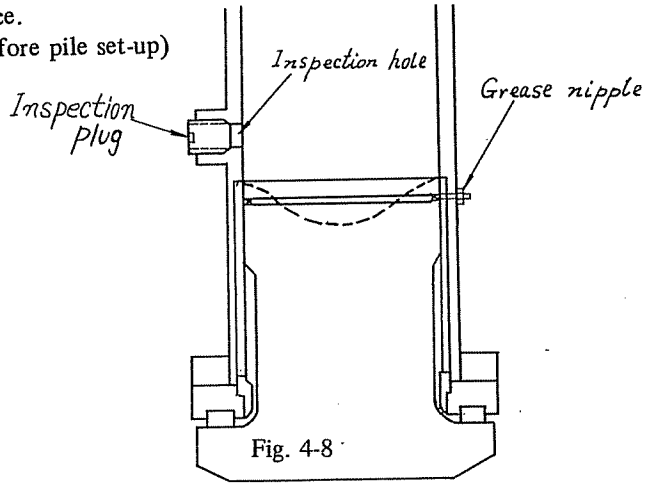


Fig. 4-8

(7) Supply superheaded cylinder oil 10 strokes to the inner surface of the fuel pump driving cylinder from the grease nipple using the grease pump. During operation, supply it 10 strokes every 20 minutes of operation.

(8) Applying grease on the lead
Apply cup grease slightly on the lead, guide jaw and guide gib.
They will wear rather quickly without grease application.

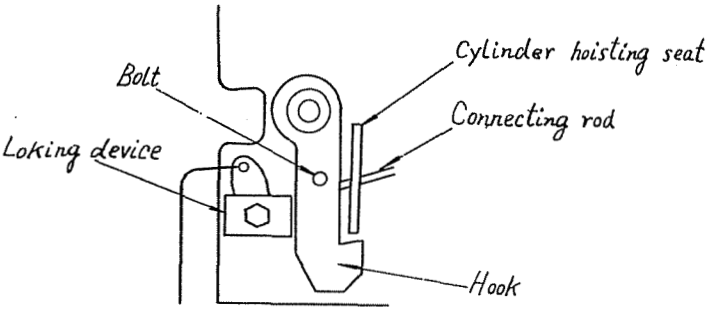
(9) Cleaning of the lower piston hollow
Remove the inspection plug of the lower cylinder inspection hole and insert the cloth-wound cleaning wire (attached tool) in order to remove dirty oil, moisture and other dust particles from the lower piston hollow.
Then, let the upper piston go down and clean the hump at the end of the upper piston by inserting the cleaning wire from the inspection hole.
After cleaning, replace the inspection plug.
(Caution)
Check to see if the thread of the inspection plug is oily.
An oily plug is hard to remove because it tends to burn and stick during operation. Therefore, apply MOLYBDENUM DISULFIDE or GRAPHITE to the threads of the inspection plug.

4-3 Pile Set-up

(1) Sling the rope around the pile to bring the pile near the mast.
(Caution)
(a) Do not draw the pile positioned far from the mast because the mase will fall over.
(b) Put down the hammer when drawing the pile.
(c) If the pile does not move when drawing the pile from far, sling the rope at the mast side from the center of the pile and draw the pile raising slightly on the mast side. Move the position of rope to 1 m from the head of the pile when the pile comes near the mast.

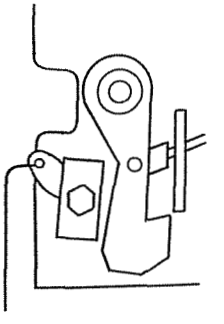
(2) Setting-up the pile.
Set the head of the pile at the point when the pile is to be driven.

(3) Set the locking device of the starting device to the locking position.
(Caution)
(a) When hoisting the hammer with the starting device, check to see that the locking device is set to the normal position to support the hook and that hook holds the cylinder hoisting seat.
(b) In the case when one of the two hooks holds the hoisting seat at the time of hammer hoisting, it is because that the connecting rod or bolts are bent. In this case, replace or repair them.
Otherwise, the hooks will be off and the hammer will fall down.



< Hammer Hoisting >

Fig. 4-9



< Upper Piston Hoisting >

Fig. 4-10

(4) Operate the hammer hoisting winch drum and raise the hammer a little above the head of the pile.

(5) Set the pile up

(6) (In case of Conc

Spread a straw

(7) Set the pile ham
(Note)
Do not se
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(8) Reset the lockir

4-4 Starting

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(5) Set the pile up vertically by rotating or moving the mast forward and backward.

(6) (In case of Concrete Pile)

Spread a straw mattress or something as a buffer on the head of the pile.

(7) Set the pile hammer slowly down on the pile.
(Note)

Do not set up the pile from the locking device side because the pile or the pile drawing rope may catch the ratchet, locking device of the starting device, and then these devices rotate resulting in the sudden fall of the hammer by opening of the right and left hooks.

(8) Reset the locking device to the starting position.

4-4 Starting

(1) Put the locking spindle at the top of the fuel tank into the shallow slot to open the fuel cock. (Finish this step before erecting the pile in position).

(2) Loosen the air bleeder screw above the fuel inlet connector bolt of the fuel pump to deaerate the inside of the fuel pump. When it stops to spurt bubbles, tighten the air bleeder screw completely.
(Finish this step before erecting the pile)

(Note)

Be sure to deaerate before the initial operation after delivery and every time when the pile hammer is newly brought to a different construction site and also when the fuel is newly supplied after completely exhausting.

(3) Pull the resetting rope of the stopping lever and confirm that the stopping lever is at the position for running.

(4) Rotate the fuel regulator pully and adjust the fuel delivery rate to about ½.

(5) Move the starting device downward and hook the pawl to the flange of the upper piston.

(6) Lift up the starting device by the winch (hammer lifting drum). (see Fig. 4-11) When it is lifted about 90 cm, the pawl of the starting device is released from the upper piston, and then the piston falls down and the hammer is started. At the time, return the starting device immediately to its standard position by lifting it more than 80 cm above the hammer body.

(7) If the pile penetrating rate per blow is less than 10 cm, combustion is repeated and the pile is struck continuously. However, for the initial starting after bringing the pile hammer to a new construction site, air is sometimes contained in the fuel piping, and it does not sometimes start by only one starting operation.

(8) If continuous combustion does not begin even if the pile penetrating rate per blow is less than 10 cm, reset the fuel regulator pully so that fuel injection amount is increased. If the fuel injection amount is set too large from the beginning, the upper piston might jump out of the upper cylinder.

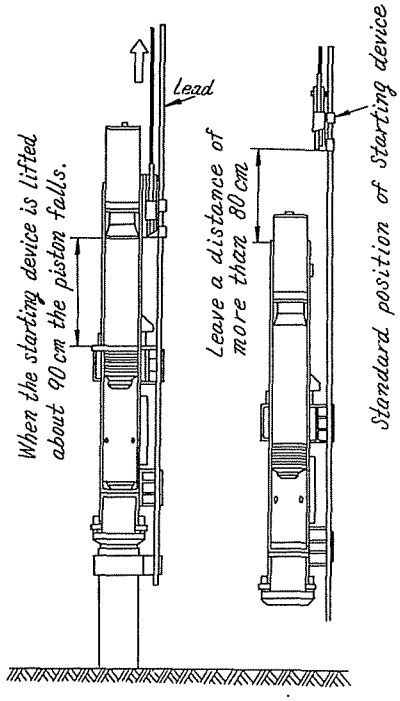
Lead
When the starting device is lifted about 90 cm the piston falls.
Leave a distance of more than 80 cm
Standard position of starting device

Fig. 4-11

(9) When continuous striking begins, adjust the fuel delivery rate so that the jumping height of the upper piston becomes about 2.0 m and begin continuous operation.

4-5 Cautions for Starting

(1) Use the starting device at the upward and downward travelling speed of 10 – 12 m/min.

(2) Model IDH–J22 diesel pile hammer has excellent ignitability. Therefore, if it is started by injecting the fuel at the maximum fuel delivery rate in such cases when lubricating oil for the upper piston sliding surface or superheated steam cylinder oil for lubricating the lower piston is staying on the concave surface of the lower piston, excessive combustion pressure (explosion) may be caused, and a serious accident such as jumping out of the upper piston may result.
Therefore, when starting in such cases as mentioned below, pay full attention to adjust the fuel regulator pully so that the fuel delivery rate for starting ignition becomes less than ½ or pull out the inspection plug at the lower cylinder and wipe the concave surface of the lower piston with a piece of clean cloth before starting.

(a) Starting for the initial operation after delivery.
(b) Starting for the initial operation after newly bringing into a construction site.
(c) Starting just after oiling to the upper and lower pistons.
(d) Initial starting in the morning after stopping overnight.
(e) Starting after stopping for more than 30 minutes.

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4-6 Cautions during

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(3) When the ground is too weak and the resistance is too small or when the pile is too light, the pile may penetrate into the ground more than about 10cm by one blow.
In such case, pull the rope of the fuel stopping lever and strike without combustion by several blows by keeping the fuel injection stopped. Or, set the fuel delivery rate small so that the pile penetration per blow becomes less than about 10 cm.
If the pile penetration per blow becomes more than 20 cm, serious damage to the pile hammer may be caused such as breakage of the pile cap hanging ropes, damage or deformation of the inner and outer end rings, and so forth.

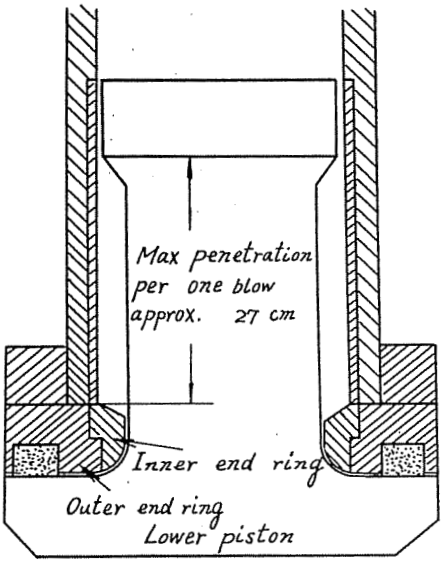

Fig. 4-12

(4) When striking without combustion, pull the fuel stopping lever to stop fuel injection, and moreover, keep the setting of the fuel delivery rate at ½ through 2/3 by adjusting the fuel regulating pully. Never perform striking without combustion by keeping the fuel regulator pulley turned fully counterclockwise (fuel delivery rate is zero). Otherwise, disorder in the fuel pump may be caused. Besides, as the fuel delivery rate is to be adjusted by pulling the rope, repeat practice many times beforehand until you can fully understand the relation between the rope movement and the fuel delivery rate (movement of the control rack).

4-6 Cautions during Running

(1) When the pile hammer is running, do not approach the hammer but stay at more than 4m distance from it.

(2) After starting, immediately, lift up the starting device more than 80 cm higher than the hammer body, and keep it at that height during running. By this, it is prevented from touching the ram during running and to cause troubles.

(3) During running, be sure to keep on holding the fuel regulator rope and control the fuel so that the jumping height of the upper piston does not exceed 2.5 m.

(4) When the upper piston jumps up abnormally, pull the fuel stopping rope at once and suspend the operation.

(5) If the ground becomes soft suddenly during operation and the pile penetration per blow for the succeeding blows becomes more than about 10 cm, pull the fuel stopping rope at once to stop the operation of the fuel system and to perform striking without combustion, or keep on running by adjusting the fuel delivery rate to the adequate value.

(6) When the tip of the pile comes to a hard ground and the pile penetration per 10 blows becomes less than 5 mm, stop the operation and change the hammer for one of larger capacity. Otherwise, the hammer might be damaged.

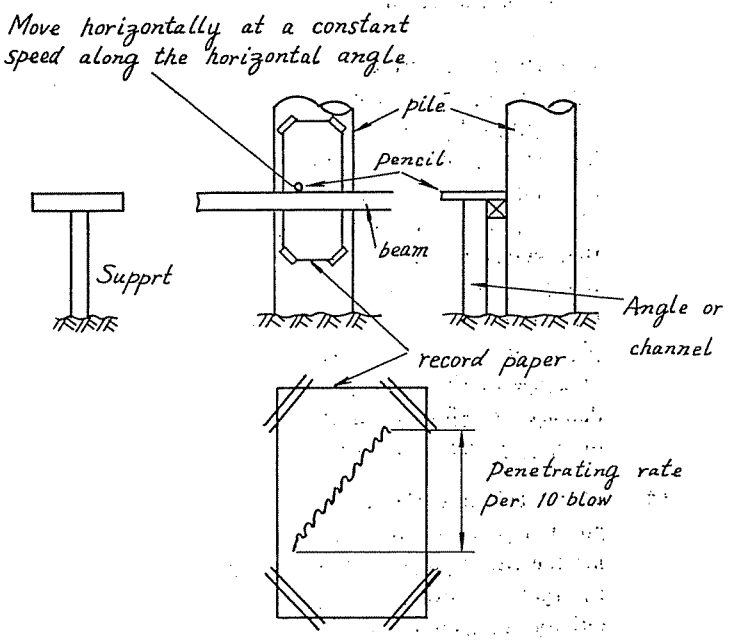

Fig. 4-13 How to Measure the Pile Poneterting Rate

4-7 Stopping

(1) When finishing to drive a pile to the specified depth and proceeding to drive the next pile (When pile driving is to be continued):

(a) Stop the fuel supply by pulling the rope of the fuel stopping lever and stop the hammer.

(b) Put the locking device of the starting device to the locking position and lift up the hammer body by the winch, and then lift the bottom end of the pile cap to about 50 cm above the ground surface.

(c) Move the piling frame to the position for driving the next pile.

(d) Place the hammer on the wooden plate on the ground.

(e) Prepare to erect the next pile.

(2) When finishing the pile driving work:

(a) Stop the fuel by pully the rope of the fuel stopping lever and stop the hammer.

(b) Put the protective cover on the upper cylinder.

(c) Screw the threaded plugs into the exhaust ports.

4-8 Cautions for Stopping

(1) In general, stop the operation by pulling the fuel stopping rope. Do not stop the operation by making the fuel delivery rate zero by pulling the fuel control rope and turning the fuel regurator pulley fully counterclockwise.

(2) However, when the operation does not stop even if the fuel stopping rope is pulled

stop the operation by turning the fuel regulator pulley fully counterclockwise by pulling the fuel control rope. (This is only for the case when the fuel stopping device is out of order.)

4-9 Important Items on Operation

(1) Do not drive the hammer without proper alignment

In other words, the center of the hammer has to hit positively the center of the pile, and the head of the pile has to be flat and centered with the hammer center line.

(2) Do not use a worn lead as the hammer will come off the lead and fall. It is very dangerous to use a worn or bent lead.
The servicable limit of the lead width is

* Use a lead of the following specification
  Lead outside dimension 398 – 400 mm
* Adjust the hammer guide clamp according to the following
  Hammer guide clamp inside dimension 401 – 405 mm
* The clearance between the lead and hammer guide clamp should not exceed 7 mm when the hammer is pushed to one side.

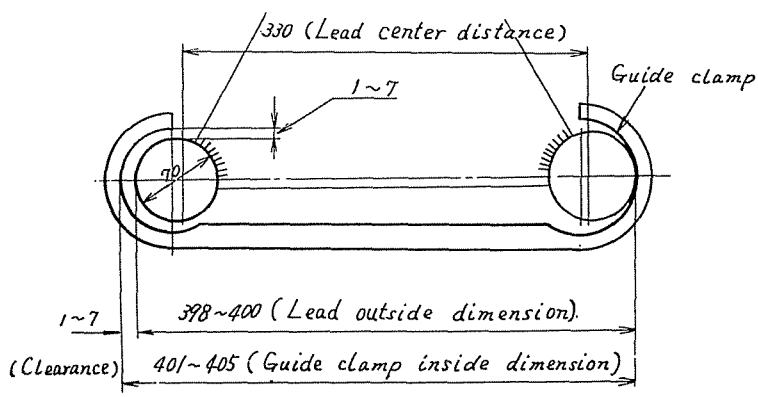

Fig. 4-14 Lead dimension and adjusting clearance

(3) Take care not to introduce sand particles, steel chips or welding slag into the cylinder as they may score the cylinder and upper piston.

(a) If the sand particles, steel chips or welding slag is attached to the lead, they will fall down, from vibration, into the cylinder.
Therefore clean the lead thoroughly to remove them.

(b) Place the protecting cap on top of the upper cylinder, attach the protecting plate, and plug the exhaust port, when the welding or other maintenance is performed on the hammer above the exhaust port with the hammer attached to the lead. Remove the welding slag and steel chips from the lead and hammer after welding is finished.

(4) Observe the following cautions

Negligence will cause the pawl of the starting device to engage in the wrong position of the upper cylinder, score the upper piston and break the pawl. Then the cylinder surface will be damaged by the broken pieses of the pawl.

(a) When the laking device of the winch brake is set incompletely, the brake locking device will be disconnected, causing the starting device to fall from vibration. Therefore, make sure it is set completely.

(b) The upper piston will move up and down by the compressed air inside the cylinder for about 10 – 26 seconds after the operation has stopped. Therefore, do not let the starting device down until after the vibration has stopped.

(5) Cracking of the Lower Cylinder

Extreme care should be taken during operation as the lower cylinder may crack when the pile hammer is subjected to the following conditions.

(a) The center of the hammer is not aligned with that of the pile (or pile cap).

(b) The head of the pile (pile cap) is not flat.

(c) The hammer is operated continuously when the pile penetration is less than 5 mm per 10 blows.

(d) The hammer is operated continuously without supplying lubricating oil by stopping the hammer every 15 – 20 minutes.

(e) A worn or broken damper rubber ring is used.

(f) The hammer is operated without cutting fuel oil, even when the pile penetration is excessive (more than 100 – 200 mm per blow).

(6) Never pad (weld) the pawl end of the tripping device and the craw of the right/left hooks for the hammer. The chipped pawl or hook is extremely dangerous to the operation.

(7) The measuring

(a) Measuring

The mear
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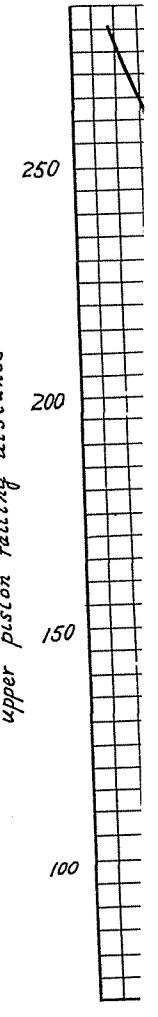
**The rela
blows.**

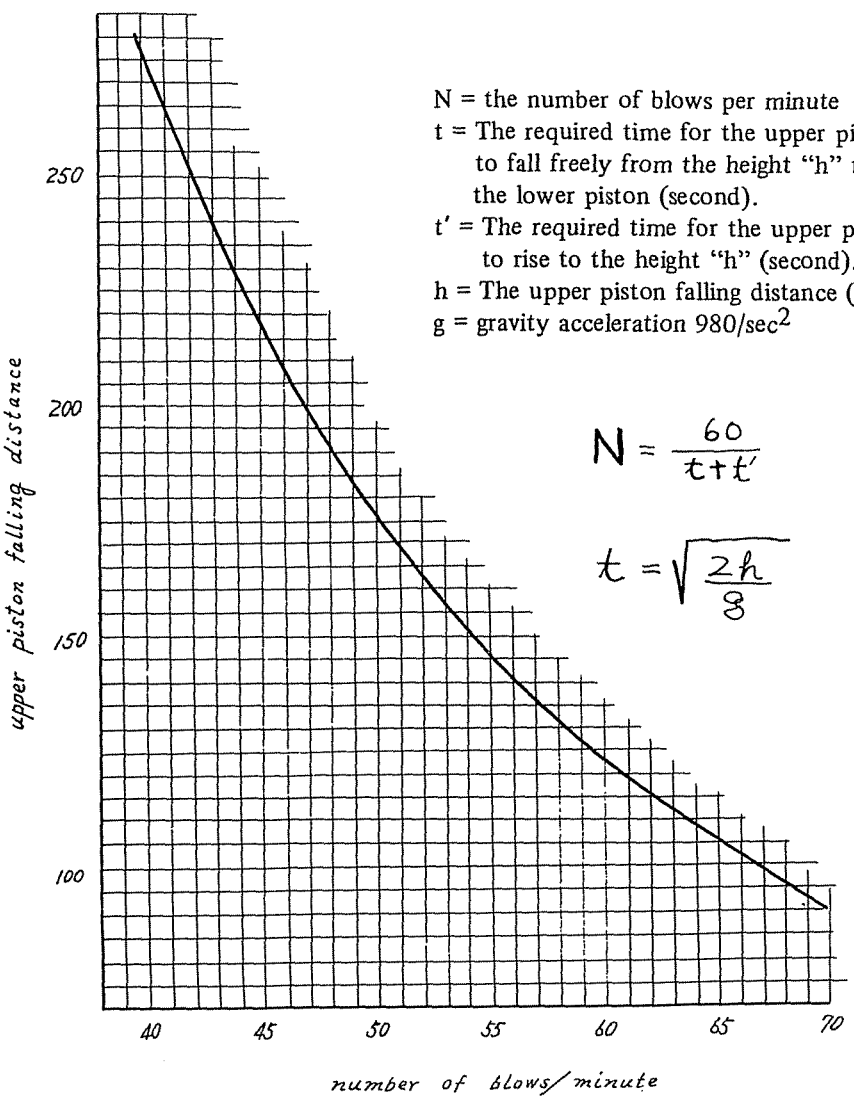


(7) The measuring procedure of the upper piston falling distance.

(a) Measuring procedure with a diagram

The mean falling distance can be determined with the diagram (the upper piston falling distance by the number of blows per minute), by measuring the number of blows per minute. This diagram is made according to calculation, but it gives the correct actually measured result.

The relation between the upper piston falling distance and the number of blows.



N = the number of blows per minute
t = The required time for the upper piston to fall freely from the height "h" to the lower piston (second).
t' = The required time for the upper piston to rise to the height "h" (second).
h = The upper piston falling distance (cm)
g = gravity acceleration 980/sec^2

$$N = \frac{60}{t+t'}$$

$$t = \sqrt{\frac{2h}{g}}$$

Fig. 4-15

(b) Eye-Measurement

The falling distance of the upper piston can be measured by comparing the actual return height of the upper piston with the diagram (upper piston falling distance).

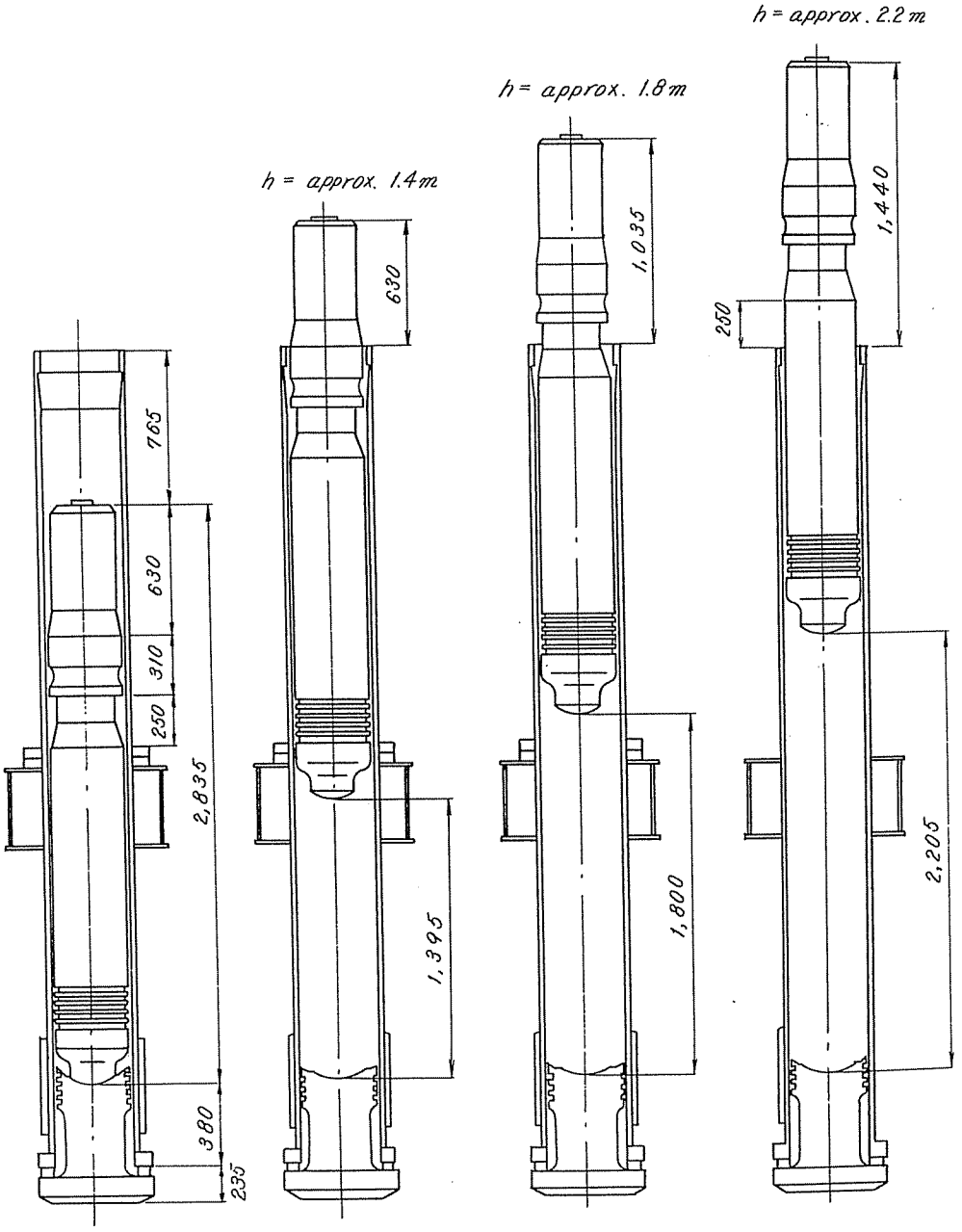


Fig. 4-16

Chapter 5

For Model IDH diesel pil
explained below.
The following running hc
diesel pile hammer is use
it is necessary to shorten
actual condition at site.

5-1 Daily Routine

(1) If any one of
missing, retig

	Part No
1	J15101
2	J15501
3	J15100
4	J1511(
5	Pipe jo

(2) Supply lubr

Supply oil t

5-2 Routine at Eve

(1) Perform the

(2) If the rubb
service limi

(3) Check the
they are w
new ones.

(4) Disassembl

(5) Dismount
injection p
valves. If
new ones.
mounting

Chapter 5 PERIODICAL CHECKING AND MAINTENANCE

For Model IDH diesel pile hammers, periodical checking and maintenance are required as explained below.
The following running hours are for the operation at a place of normal conditions. If the diesel pile hammer is used at such place where much dust and sand grains are contained in air, it is necessary to shorten the interval for periodical checking and maintenance according to the actual condition at site.

5-1 Daily Routine

(1) If any one of the bolts and nuts as listed below is becoming loose or any locking is missing, retighten the loosened ones.

	Part No.	Part Name	Remarks	Q'ty
1	J151012	NUT, for guide jaw		12
2	J155015	BOLT, for guide grib		8
3	J151007	NUT, for end ring		16
4	J151102	BOLT, tightening	upper and lower cylinders	12
5	Pipe joints, bolts and nuts for the fuel pump and fuel system.			

(2) Supply lubricating oil

Supply oil based on the section 3–4 "Lubricating Instructions".

5-2 Routine at Every 250 Hours of Net Running Time

(1) Perform the same checking and maintenance as in the daily routine (5 - 1)

(2) If the rubber ring for shock absorbing for the lower cylinder is worn out to the service limit or broken, change it for a new one.

(3) Check the guide jaw for the lower cylinder and guide gib for the starting device. If they are worn out to the service limit, repair them by padding or change them for new ones.

(4) Disassemble and clean the fuel filter.

(5) Dismount the nozzles, remove the carbon deposits at the nozzle tip and test the injection pressure. Disassemble the nozzles and check the nozzle tips and needle valves. If any galling or hairlines by sliding are found, repair them or replace with new ones. After reassembling, be sure to test the injection pressure before re-mounting to the fuel pump.

5-3 Routine at Every 500 Hours of Net Running Time

(1) Perform the same checking and maintenance as in the case of 250-hours routine (5 - 2).

(2) Clean the piston ring grooves of the upper and lower pistons and completely remove carbon deposits. Check the piston rings and replace them with new ones if worn out or thermal strain is caused.

(3) If the inner end ring is worn out to its service limit or damaged, replace it with a new one.

(4) Disassemble and clean the fuel pump driving device and remove carbon deposits in the piston ring grooves. If the cylinder is worn or if the piston rings are worn out or causing thermal strain, replace the defective parts with new ones.

(5) Disassemble and clean the fuel pump. If any damage is found on the delivery valve seat or if any galling or hairlines are found on the plunger barrel, make necessary repair or replace the defective part with a new one. If the plunger spring is worn out, replace it with a new one. If any other part is worn out or causing any defect, make necessary repair or replace the part with a new one.

(6) Inspect the starting device. If any part is worn out, repair or replace with a new one. As for the tip of the pawl and the sharp end of the right/left hooks for lifting the hammer body, never repair by padding. If they are worn out, replace with new ones.

5-4 Routine at Every 1,000 Hours of Net Running Time

(1) Perform the same checking and maintenance as in the case of 500-hours routine (5 - 3).

(2) Replace grease nipples of the lower cylinder with new ones.

(3) Disassemble and clean the stopping device. If any galling or defect is found on the plunger or cylinder, repair the defective part or replace with a new one. If the stopping lever is worn out, repair it by padding or replace with a new one.

5-5 Routine at Every 3,000 Hours of Net Running (Special Checking & Maintenance)

(1) Perform the same checking and maintenance as in the case of 1,000 hours routine (5 - 4).

(2) Measure the bore dia. of the upper/lower cylinders. If the service limit is reached, repair by machining and replace the parts as follows.

(a) Re-bore the upper and lower cylinders and make them oversized.

(b) Make the piston ring grooves of the upper and lower piston oversized.

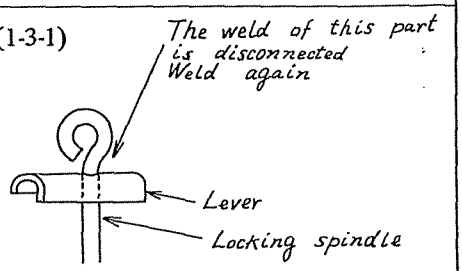
(c) Replace the catch piston ring and piston rings with oversized ones.

(3) Perform the leakage test of the plunger cylinders of the fuel pump and stopping device. If the service limit is reached, replace them with new ones.

(4) Measure the bore dia. of the fuel pump driving cylinder, and replace with a new one if its service limit is reached.

Trouble	
(1) The hammer operation does not start even if the upper piston is dropped several times.	(

Chapter 6 TROUBLESHOOTING

Trouble	Cause	Remedy
(1) The hammer operation does not start even if the upper piston is dropped several times.	(1-1) Fuel is not contained in the fuel tank.	(1-1-1) Supply fuel to the fuel tank.
	(1-2) The locking spindle of the tank is at the CLOSED position.	(1-2-1) Put the locking spindle of the fuel tank to the OPEN position (shallow slots).
	(1-3) The weld between the locking spindle of the fuel tank and the lever is disconnected. Therefore even if the lever is set to OPEN, the locking spindle is closing the outlet port, and fuel does not flow to the fuel pump.	(1-3-1) 
	(Note) In the above case, the locking spindle sometimes moves up and down with a very small stroke because of the vibration caused by the operation. Thus, small quantity of fuel flows to the pump and the hammer stops after several times of combustion.	
	(1-4) A foreign matter has clogged in the filter or feed pipe, and fuel does not flow.	(1-4-1) Clean inside of the filter, feed pipe and the fuel tank.
	(1-5) Air is contained in the fuel pump.	(1-5-1) Loosen the air bleeder screw of the fuel pump and deaerate the pump. Then, retighten it securely.
	(1-6) The fuel pump regulator pulley is fully turned counterclockwise.	(1-6-1) Gradually turn the fuel regulator pulley clockwise, and start.
	(1-7) The stopping lever is kept pulled. (The lever is inclined forward)	(1-7-1) Pull the resetting rope of the stopping lever and put the lever to the position for running.
	(1-8) Water is staying on the concave top surface of the lower piston and combustion is disturbed.	(1-8-1) Clean the concave top surface of the lower piston with a piece of dry cloth.

Trouble	Cause	Remedy
(1) The hammer operation does not start even if the upper piston is dropped several times.	(1-9) Moisture is contained in fuel. Or, when operating in the rain, moisture enters into the combustion chamber and causes poor combustion. (Exhaust gas contains steam and looks white)	(1-9-1) Drain the moisture in the fuel tank, or change fuel for new batch which does not contain moisture.
	(1-10) The operation of the fuel pump plunger is stopped by sticking because a foreign matter is caught in the clearance between the pump cylinder and the pump plunger or rust is caused. Or the plunger is broken. (Note) In this case, turn the fuel regulator pully clockwise or counterclockwise. If it is hard to move or does not turn at all, the plunger is sticking. So, overhall the fuel pump.	(1-10-1) When rust is caused or the plunger is broken, replace the assembly of the plunger and cylinder with a new one. (1-10-2) If the plunger and cylinder are sticking and causing galling or seizure by clogging of a foreign matter, repair the plunger and cylinder if the defect is not serious. (As for the repairing method, refer to the item 7-1-3 of this manual.) Or, replace the assembly of the plunger and cylinder with a new one.
	(1-11) The slit of the skirt of the control sleeve is broken, and the plunger is at the position of ZERO for fuel delivery rate. (Note) In this case, pull out the holder and the delivery valve at the top of the fuel pump. Then, rotate the fuel regulator pully clockwise or counterclockwise, and check if the top of the plunger turns or not.	(1-11-1) Replace the control sleeve with a new one.
	(1-12) As the pump cylinder and the plunger are worn out, fuel leaks through the clearance between them.	(1-12-1) Replace the assembly of the pump cylinder and pump plunger with a new one.

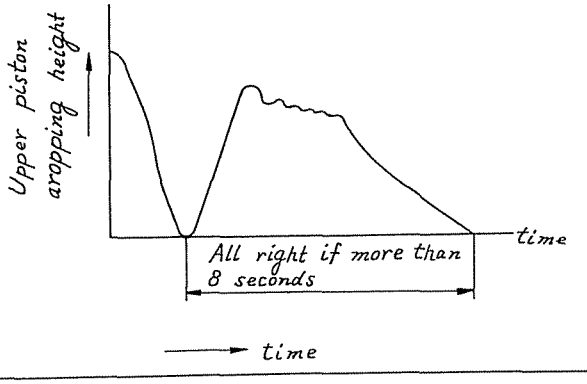
Trouble

(1) The hammer operation does not start even if the upper piston is dropped several times.

Trouble	Cause	Remedy
(1) The hammer operation does not start even if the upper piston is dropped several times.	(1-13)The temperature is extremely low.	(1-13-1) Generally, the hammer can be started normally after several blows without combustion. Or, pour very small quantity of gasoline through an exhaust port. (Or, use ETHER.)
	(1-14)As the piston rings of the fuel pump driving piston are worn out more than the service limit, the fuel pump does not work.	(1-14-1) Replace the piston rings with new ones.
	(1-15)As the piston rings for the upper and lower piston are worn out more than the service limit, the compression pressure is low. (If the time between A and B is more than 8 seconds by the following compression test, the piston rings are not worn out.)	(1-15-1) Replace the piston rings for the upper and lower pistons with new ones.

Note; Method of Compression Test

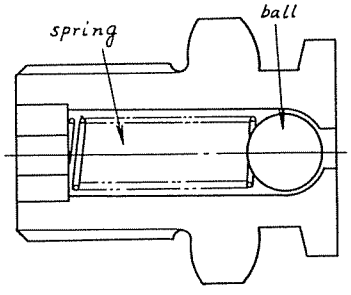
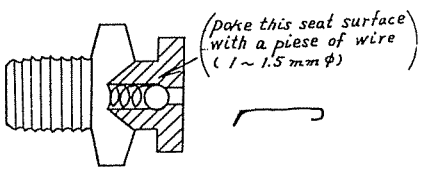
(1) Before the compression test, fully pull down the rope of the fuel stopping lever, and stop the fuel.
(2) Lift the upper piston with the starting device and then drop it.
(3) Read the second hand of your watch when the striking sound of the upper and lower pistons is heared.
(4) The upper piston jumps up and the falls again. Read the second hand again when the striking sound is heard.
(5) If the time between the first and second striking sounds is less than 8 seconds, carbon deposits are accumulated in the piston ring grooves, the rings are sticking, the free gap of the rings is reduced and the service limit is reached.



Trouble	Cause	Remedy
(2) Operation suddenly stops during continuous striking.	(2-1) The locking spindle of the fuel tank has moved from the position of OPEN to CLOSED by the vibration during operation.	(2-1-1) Change the position to OPEN.
	(2-2) The welded lever of the locking spindle has been disconnected.	(2-2-1) Weld the lever again.
	(2-3) During continuous operation, the tip of the pile has reached a very soft stratum, and the pile penetrating rate has become very large.	(2-3-1) This is not caused by disorder in the pile hammer itself. Start again.
	(2-4) The operation of the fuel pump plunger is stopped by sticking because a foreign matter is caught in the clearance between the pump cylinder and the pump plunger, or rust is caught. Note: In this case, turn the fuel regulator pulley clockwise or counterclockwise. If it is hard to move or does not turn at all, the plunger is sticking. So, overhaul the fuel pump.	(2-4-1) When rust is caused, replace the assembly of the plunger and cylinder with a new one. (2-4-2) If the plunger and cylinder are sticking and causing galling or seizure by clogging of a foreign matter, repair the plunger and cylinder if the defect is not serious. (Refer to the item 7-1-3) Or, replace the plunger and cylinder assembly with a new one.
	(2-5) The slit at the skirt of the control sleeve is broken, and the plunger is at the position of zero for fuel delivery rate. Or, the small flange at the bottom of the plunger is broken. Note: To check the breakage of the slit at the skirt, pull out the holder and the delivery valve at the top. Rotate the regulator pulley clockwise or counterclockwise by looking at the top of the plunger through the hole at the top. Thus, judge if it is broken or not.	(2-5-1) When the slit at the skirt is broken, replace the control sleeve with a new one. (2-5-2) When the plunger is broken, replace the plunger and cylinder assembly with a new one.

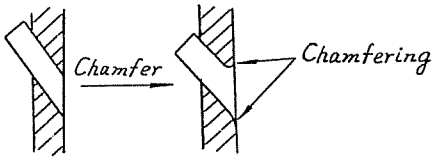
Trouble
(2) Operation suddenly stops during continuous striking.
(3) Jumping height of the upper piston has become unusually high. The max. jumping height is 2.6m. The striking frequency at that time is about 41 blows/min.
(4) Even if the ground becomes hard, the jumping height of the upper piston is low. Or, the jumping height is irregular and the difference is more than 20cm.

Trouble	Cause	Remedy
(2) Operation suddenly stops during continuous striking.	(2-6) Because of damage to the fuel filter element, dust and foreign matters have clogged in the piping and fuel pump, and fuel does not flow.	(2-6-1) Replace the fuel filter element with a new one. (2-6-2) Clean the whole passage of fuel, such as the fuel piping, etc.
	(2-7) A crack is caused in the fuel piping, and oil is leaking.	(2-7-1) Replace the fuel piping with a new one.
	(2-8) The injection ports of the injection nozzles are clogged with dust, foreign matters or carbon deposits, and are blinded.	(2-8-1) Disassemble and clean the nozzle tips. (2-8-2) Or, replace the nozzle tip assembly with a new one. Note: At that time, adjust its injection pressure to 100 kg/cm^2 by the nozzle tester.
(3) Jumping height of the upper piston has become unusually high. The max. jumping height is 2.6m. The striking frequency at that time is about 41 blows/min.	(3-1) Fuel injection rate is too large.	(3-1-1) Reduce the fuel injection rate. That is, pull the fuel regulator rope counterclockwise.
	(3-2) The tip of the pile reached a hard stratum, and the hammer is overloaded.	(3-2-1) When the pile penetrating rate per blow is less than 0.5mm, stop the operation.
(4) Even if the ground becomes hard, the jumping height of the upper piston is low. Or, the jumping height is irregular and the difference is more than 20cm.	(4-1) The needle valve of the nozzle is sticking. So, the fuel is not atomized satisfactorily, and the explosion force is weak.	(4-1-1) Disassemble and clean the nozzle. (4-1-2) Or, replace the nozzle tip ass'y with a new one. Note 1; The nozzle tip and the needle valve are not interchangeable. Change them as the assembly. Note 2; When the nozzle tip is disassembled or replaced, be sure to adjust the fuel injection pressure to 100 kg/cm^2 by the nozzle tester.
	(4-2) The delivery valve holder is loosened and fuel is leaking.	(4-2-1) Retighten the delivery valve holder. Note; The tightening torque should be 30 – 60 kg-m.
	(4-3) The union nut in the fuel piping is loosened and fuel is leaking.	(4-3-1) Retighten the union nut.

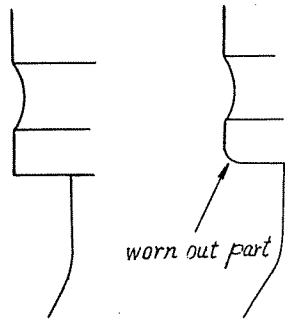
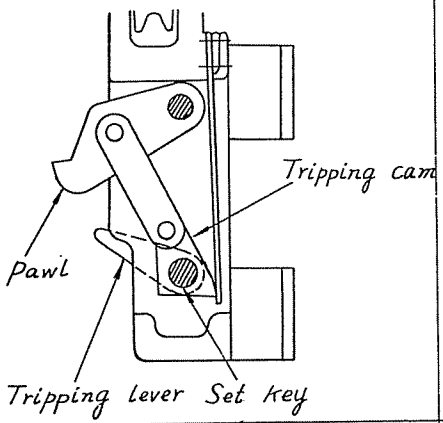
Trouble	Cause	Remedy
(5) Exhaust gas is dark. (Normal color of exhaust gas is bluish grey.)	(5-1) As fuel injection rate is too large, incomplete combustion is caused.	(5-1-1) Reduce the fuel injection rate, in the same way as the above item (3-1-1).
	(5-2) When too much lubricating oil is supplied to the lower piston, oil flows on to the concave surface of the lower piston and burns. (This occurs only for the operation just after lubricating to the lower piston.)	(5-2-1) Even if too much oil is supplied at once, it will burn. Lubricate at every 15 – 20 minutes with adequate amount of oil. Do not supply excessive oil for one lubrication.
	(5-3) The needle valve of the nozzle is sticking. So, fuel is not atomized enough, incomplete combustion is caused, and the exhaust gas becomes dark. In some cases, white smoke is caused at the lower piston.	(5-3-1) Disassemble and clean the nozzle. (5-3-2) Or, replace the nozzle tip assembly with a new one.
(6) The upper piston is colored dark.	(6-1) Lubricating oil in the oil basin of the upper piston has exhausted. Or, the oiler plug is inserted deeper than the normal depth and is closing the oil holes through which lubricating oil is to be sprinkled out. (Refer to F. 4-7).	(6-1-1) Supply lubricating oil to the oil basin of the upper piston. Or, cut off the tail of the oiler plug which is projecting into the oil basin from the top of the upper piston. (Refer to F. 4-7).
(7) Even if the ground becomes hard, the jumping height of the upper piston is less than 1.0m. Besides, compressed air and exhaust gas are leaking. By the compression test, the time from A to B is less than 8 seconds.	(7-1) Compressed air is leaking because of strain of the spring of the grease nipple, foreign matters such as carbon accumulated on the ball seat, or damage to the seat or ball surface. 	(7-1-1) Poke the ball seat surface with a piece of wire and remove the foreign matters sticked to the seat surface. If exhaust gass still leaks after the above measure, replace the grease nipple with a new one. 

Trouble
(7) Even if the ground becomes hard, the jumping height of the upper piston is less than 1.0m. Besides, compressed air and exhaust gas are leaking. By the compression test, the time from A to B is less than 8 seconds.

Trouble	Cause	Remedy
(7) Even if the ground becomes hard, the jumping height of the upper piston is less than 1.0m. Besides, compressed air and exhaust gas are leaking. By the compression test, the time from A to B is less than 8 seconds.	(7-2) Carbon accumulated in the piston ring grooves of the lower piston. So, the piston rings are sticking and the free gap is reduced. Or, piston rings are worn out more than the service limit. Thus, the compressed air is leaking.	(7-2-1) Clean the piston ring grooves and remove the carbon deposits. If the piston rings are worn out to the service limit, replace them with new ones.
	(7-3) The thread of the inspection plug is damaged or broken. Or, the seat surface at the tip of the inspection plug is damaged. So, the compressed air leaks.	(7-3-1) Change the inspection plug with a new one.
	(7-4) The compressed air leaks because the inner surface of the lower cylinder has worn partially. (This is only for the case that the hammer is used for 100 hours or more after the piston rings are changed for new ones or after the inner surface of the cylinder is re-bored.)	(7-4-1) Re-bore the cylinder and make it oversized.
	(7-5) The compressed air leaks through the exhaust ports or the bottom end of the lower cylinder because longitudinal hairlines are caused on the inner surface of the lower cylinder or peripheral surface of the upper piston.	(7-5-1) Re-bore the cylinder and make it oversized.
	(7-6) A crack is caused at the lower cylinder, especially near the combustion chamber, and the compressed air leaks.	

Trouble	Cause	Remedy
(8) Abnormal noise is heard when the upper piston jumps up. Or, it seems that the upward and downward speed of the upper piston is slow.	(8-1) The upper or lower cylinder is deformed because it was struck with a pile or something else.	(8-1-1) Remove the deformation of the inner surface (protuberance) by a grinder.
	(8-2) Any piston rings of the upper piston has broken. Cause of Breakage: (a) Burrs are caused at the exhaust port (inside of the cylinder). (b) Burrs are caused at the joint of the upper and lower cylinders.	(8-2-1) Replace the piston ring with a new one, and take the following countermeasures if necessary. (a) Remove the barrs at the exhaust port (inside of the cylinder) and chamber.  (b) Remove the burrs at the joint of the upper/lower cylinders.
(9) When lifting the upper piston by the starting device, the piston falls halfway. Or, the starting device does not begin to lift the upper piston at once.	(9-1) When the upper piston is lifted by the starting device of which the guide gib is worn out more than the service limit, the starting device leans forward. So, the pawl cannot be hooked enough, and the piston slips off.	(9-1-1) Repair the guide gib by padding, or replace it with a new one.
	(9-2) When the guide jaw of the hammer body wears out more than the service limit, the hammer body leans forward. Therefore, the upper piston also leans forward, the pawl cannot be hooked enough, and the piston slips off.	(9-2-1) Repair the guide jaw by padding, or replace it with a new one.

Trouble

Trouble	Cause	Remedy
	(9-3) The flange of the upper piston is worn out.  	
	(9-4) The set key which is setting the tripping cam and tripping lever is broken.  	(9-4-1) Replace the set key with a new one.
	(9-5) The lower cam of the hammer body is worn out or broken.	(9-5-1) Repair the lower cam by padding, or mount a new one by welding.
	(9-6) The tip of the pawl of the starting device is worn out or broken.	(9-6-1) Replace the pawl with a new one. (Never repair by padding.)
	(9-7) When lifting the starting device, the tripping lever touches some other part and returns. So, the pawl moves down. This tends to occur when the guide gib is worn out.	(9-7-1) If the guide gib is not worn out, cut off the part which the tripping lever touches.

Trouble	Cause	Remedy
(10) When lifting the body by the starting device, the lifting hooks do not hold the body lifting hook seat. Or, one hook holds it, but the other does not hold.	(10-1)The connecting rod or the bolt is bent.	(10-1-1) Replace it with a new one or straighten the bending.
	(10-2)Tension of the ratchet returning rubber is lost, and the ratchet does not work.	(10-2-1) Replace the returning rubber with a new one.
	(10-3)The body lifting hook seat (at the upper cylinder) is worn out or bent.	(10-3-1)
	(10-4)The locking device does not function because the leaf spring for the ratchet or the claw of the locking device is worn out.	(10-4-1) Replace the ratchet or the locking device with a new one.
	(10-5)The tip of the body lifting hook is worn out or broken.	(10-5-1) Replace the hook with a new one. (Never repair by welding.)
(11) When lifting the body by the lifting device, the pawl is not released but the upper piston is lifted together. So, accidental combustion is caused when the body is placed on the pile.	(11-1)As the tip of the right hook cam for preventing the accidental combustion is worn out or broken, it cannot push the tip of the tripping lever when the body lifting hooks hold the body lifting hook seat.	(11-1-1) Repair the right hook cam by padding or replace it with a new one.
	(11-2)The key or dowel pin, which is setting the safety cam for preventing accidental combustion at the tip of the tripping lever, is broken.	(11-2-1) Replace the key or dowel pin with a new one.

7-1 Disassembly and

[DISASSEMBLING PROCEDU

	PART NAME
6	DELIVERY HOLDER
7	DELIVERY SPRING
	GASKET
8	DELIVERY VALVE ASS'Y
9	O-RING
11	BARREL
10	DEFLECTOR
	GASKET
5	RACK GUIDE SCREW
	CONTROL RACK
3	
4	CONTROL SLEEVE
2	SPRING SEAT
	PLUNGER SPRING
	PLUNGER
	GASKET
	SPRING SEAT
	PLUNGER GUIDE
1	SNAP RING

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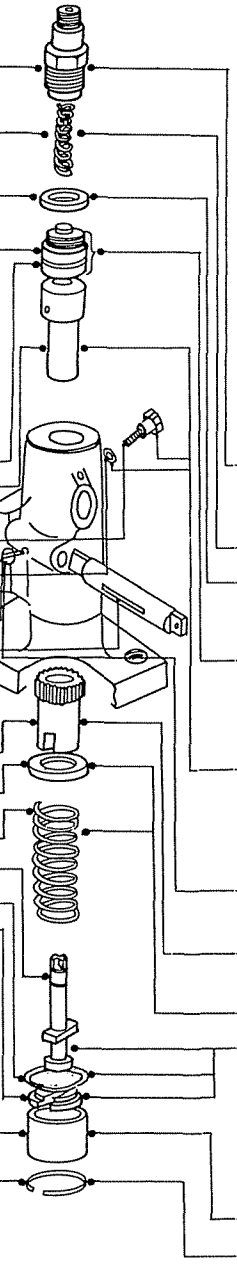
Chapter 7 MAINTENANCE STANDARD

7-1 Disassembly and Reassembly of the Fuel Pump



[DISASSEMBLING PROCEDURE]

	PART NAME	PART No.
6	DELIVERY HOLDER	J243009
7	DELIVERY SPRING	J243007
	GASKET	J243008
8	DELIVERY VALVE ASS'Y	J243006
9	O-RING	J243010
11	BARREL	J243003
10	DEFLECTOR	J243004
	GASKET	J243005
5	RACK GUIDE SCREW	J243018
	CONTROL RACK	J243017
3		
4	CONTROL SLEEVE	J243019
2	SPRING SEAT	J243012
	PLUNGER SPRING	J243011
	PLUNGER	J243003
	GASKET	J243016
	SPRING SEAT	J243013
	PLUNGER GUIDE	J243014
1	SNAP RING	J243015

[REASSEMBLING PROCEDURE]

	TOOL, REMARKS
1	Completely clean the pump housing with treaded oil.
2	Confirm that the plunger enters into the pump barrel smoothly by its own dead weight. (Note) If not, lap by the commercially available brass polishing paste. Do not use carborundum.
7	o Tightening torque ..... 30 – 60 kg·m o Wrap the top of the threaded part with a piece of waste cloth or the like in order to prevent dust or foreign matter from entering.
6	This should match the spigot part at the top of the valve.
5	
4	o Check if anything abnormal is found on the contacting surface of the valve seat and valve. (If any, apply small amount of carborundum No.600 to the seat surface only and lap it. If the defect is larger, replace the assembly of the valve and valve seat with a new one.) Insert by applying oil.
3	o Match the deflector hole of the valve to the housing side, and push the deflector in. o Be sure to insert the gasket.
8	o Insert the control rack so that the side which bears the center punch mark comes to the bottom side (control sleeve side). o Fully tighten the guide screw by a screwdriver. After tightening, confirm again that the control rack moves smoothly.
9	o Match the center punch mark of the control rack to the match mark on the gear side.
10	o Insert after cleaning carefully
11	o Insert the plunger, gasket and spring seat. o When inserting the plunger, confirm that the match mark at the slit of the control gear sleeve is matching to the marks on the two flat surfaces of the pump plunger beforehand. Then apply oil and insert. o Besides, be sure to put on the gasket without fail.
12	
13	

(NOTE 1) After finishing to assemble, push the plunger guide and confirm that it moves smoothly.
(NOTE 2) After finishing to assemble, confirm that the control rack can be moved to and fro smoothly.
(NOTE 3) Protect the threaded parts until the suction and delivery pipes are connected to the fuel pump in order to prevent dust and foreign matters from entering.

7-2 How to Repair the Plunger and Barrel (Plunger Cylinder)

When the plunger has sticked by causing galling or seizure by the dust or foreign matter caught at the clearance between the plunger and barrel, repair as described below.

(1) Leave the plunger and barrel which have caused galling or seizure as assembled in the fuel pump housing, and disassemble the other parts as described in the section 7-1 "DISASSEMBLING PROCEDURE".

(2) Insert a piece of soft wood such as a handle of a hammer or the like from the delivery valve holder side, and take out the plunger by patting it gently, and then take out the barrel.

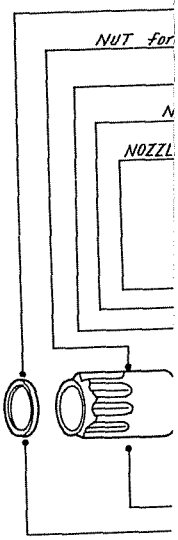
(3) By using an oilstone polish gently only the defective portions caused by galling or seizure on the outer surface of the plunger and the inner surface of the barrel. (If the defect is deep, replace the plunger and barrel as an assembly with new parts, because they are not interchangeable.)

(4) Apply the commercially available brass polishing paste on the outer surface of the plunger and the inner surface of the barrel. Insert the plunger into the barrel and polish them by rubbing them against each other.

(5) Wash away the polishing agent. Then, apply lubricating oil to the plunger and barrel, and polish them by rubbing against each other until the plunger can be inserted smoothly by its own dead weight when the barrel is placed vertically. At that time, rotate the plunger and confirm that it can be inserted smoothly at any rotated position.

(6) When the plunger can be inserted smoothly as described above, reassemble the plunger and barrel.

7-3 Disassembly and



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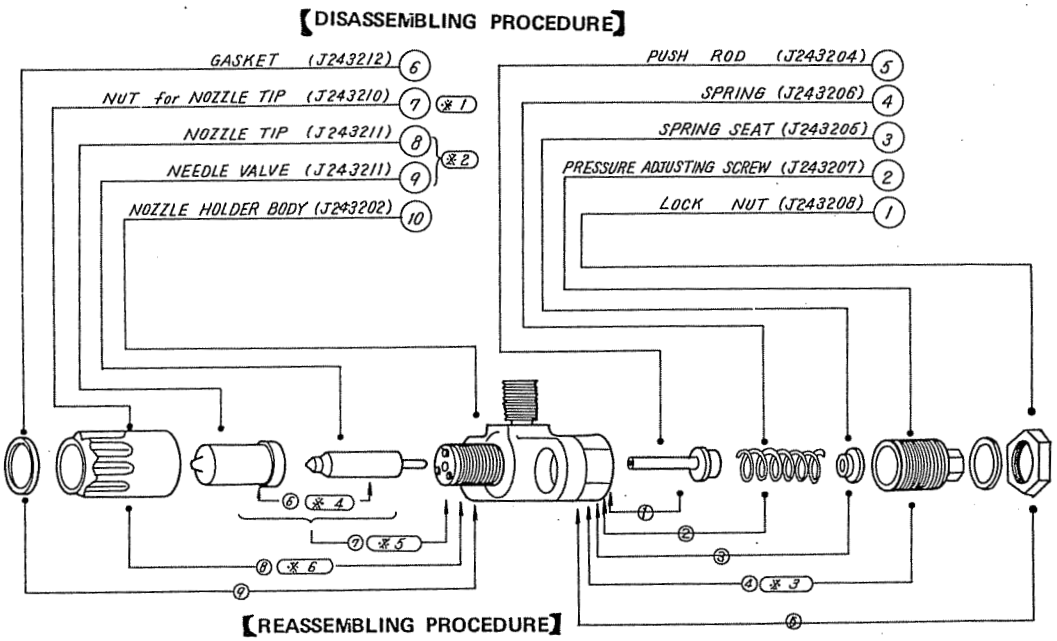
-3 Disassembly and Reassembly of the Nozzle



[Cautions for Disassembling and Reassembling]

*1 o To loosen the nozzle tip fixing nut, first clamp the nozzle holder by a vice, and loosen it by using a 19 mm ring spanner. Do not use a pipe wrench. Otherwise, the nut may be deformed.

*2 o The nozzle tip and needle valve forms one assembly. They are not interchangeable.

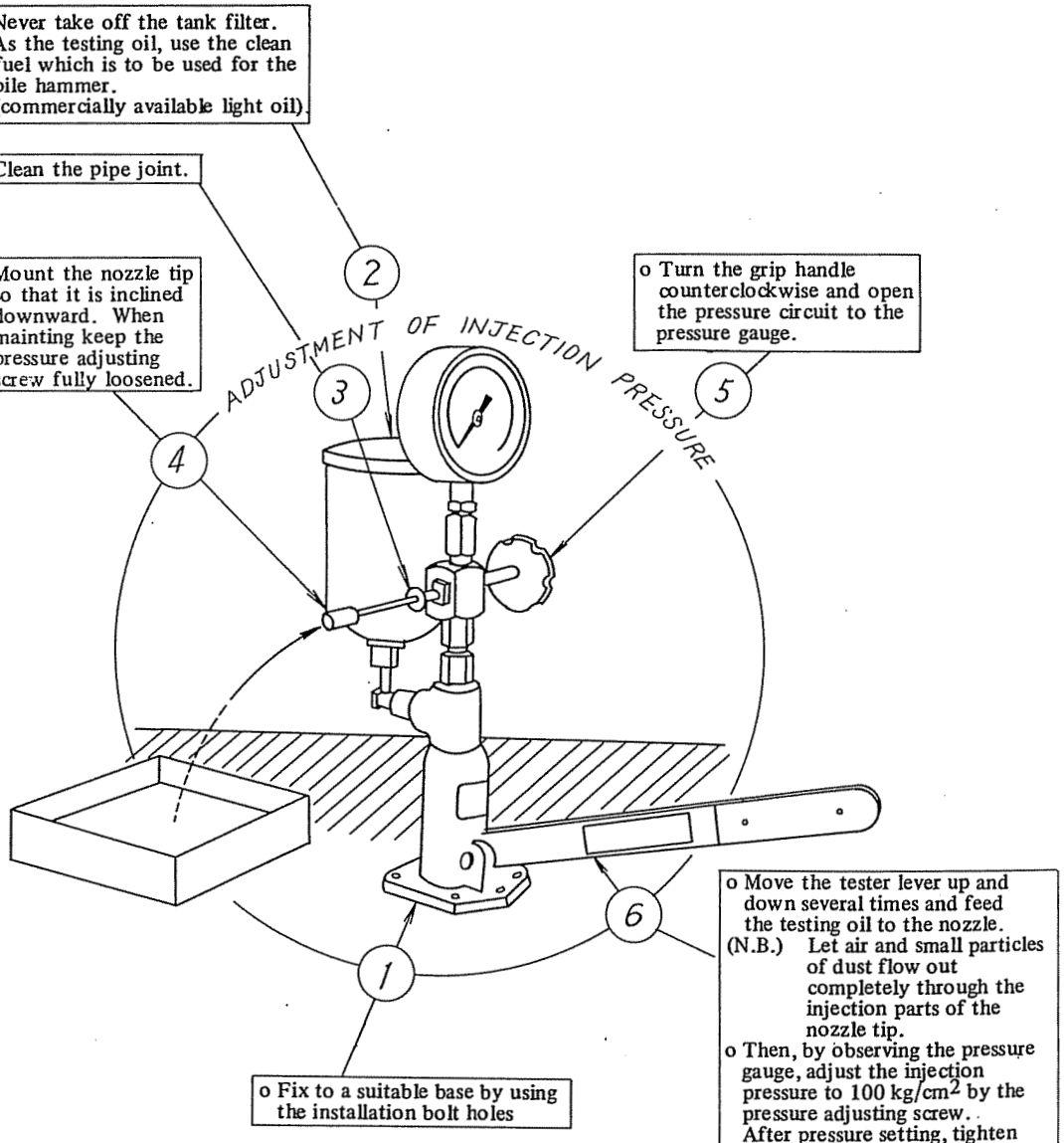
*3 o Screw in the pressure adjusting screw gently at first.
o Keep it loose until the pressure is adjusted.

*4 o Apply lubricating oil to the needle valve, and insert the needle valve into the nozzle tip. At that time, confirm that the valve can be inserted smoothly by its own dead weight by repeating this three or four times.
o If it cannot be inserted smoothly or it does not reach the bottom end, wash the parts with clean light oil. Apply a small amount of commercially avairable brass polishing paste to the needle valve and lap it by rubbing against the nozzle tip.
o Never use carborundum or lapping power.

*5 o Match the dowel pin for positioning the nozzle holder and nozzle tip, and insert the nozzle tip.

*6 o Completely tighten the nozzle tip by using the 19 mm ring spanner.

7-4 Adjustment of Injection Pressure of the Nozzle


o Never take off the tank filter.
o As the testing oil, use the clean fuel which is to be used for the pile hammer. (commercially available light oil).
o Clean the pipe joint.
o Mount the nozzle tip so that it is inclined downward. When mainting keep the pressure adjusting screw fully loosened.
ADJUSTMENT OF INJECTION PRESSURE
o Turn the grip handle counterclockwise and open the pressure circuit to the pressure gauge.
o Move the tester lever up and down several times and feed the testing oil to the nozzle.
(N.B.) Let air and small particles of dust flow out completely through the injection parts of the nozzle tip.
o Then, by observing the pressure gauge, adjust the injection pressure to 100 kg/cm2 by the pressure adjusting screw. After pressure setting, tighten the adjusting screw by the lock nut.
o Fix to a suitable base by using the installation bolt holes
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4
5
6

* Continue from the above drawing;

⑦ Adjust the injection pressure of the two nozzles, right and left, to the same value. If the pressure setting is different, fuel flows only to the nozzle with lower pressure setting, and complete combustion is disturbed.

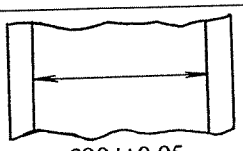
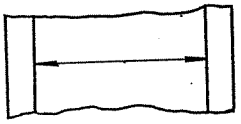
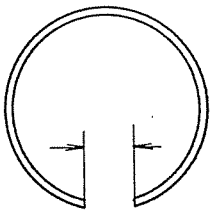
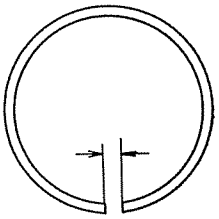
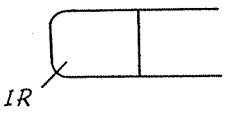
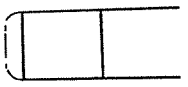
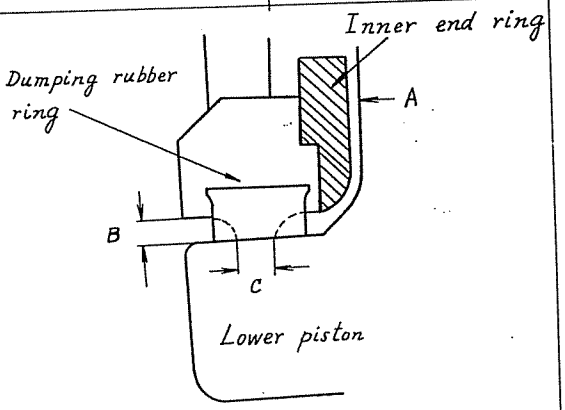
⑧ After adjusting the pressure, protect the part to connect the oil feed pipe so that dust or foreign matter will not stick to it until the nozzle tip is mounted to the pile hammer.

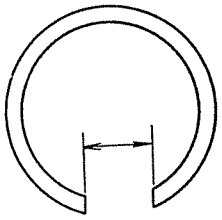
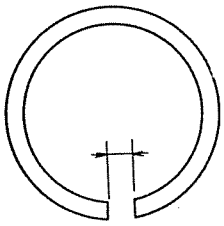
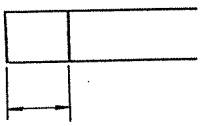
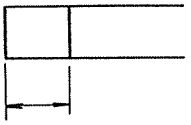
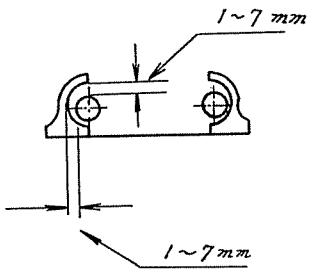
⑨ When mounting the nozzle tip to the pile hammer, be sure to fit the gasket for the nozzle tip (copper packing) without fail. Mount the nozzle holder to the hammer body with two bolts by fitting spring washer. After tightening the nozzle holder completely, lock it by a piece of wire.

7-5 Serviceable Lim

Name of Component	
Lower Cylinder	
Piston Ring Catch Piston Ring	o o
Outside Diameter of the Piston Ring	
Inner End Ring Dumping Rubber Ring	

7-5 Serviceable Limit of the Wearing Part

Name of Component	When new	Serviseable limit	Description
Lower Cylinder	 390ϕ+0.05 −0	 390.3ϕ	Rebore the lower cylinder when the inner surface wears about 0.3mm (Reboring is possible 3 times.)
Piston Ring Catch Piston Ring	 o piston ring 48mm o catch piston ring 48.8mm	 o piston ring 15mm o catch piston ring 25mm	Replace the piston ring when the flee clearance reaches the serviceable limit.
Outside Diameter of the Piston Ring			Replace the piston ring when the 1mm chamfering on the outer periphery is worn out.
Inner End Ring Dumping Rubber Ring	 A dimension 0.15mm B " 15 mm	A dimension 1mm B " 5mm C " ... 1/3 of the area contacting the piston.	1) Replace them when the clearance (dimension A) between the inner end ring and the contact surface of the lower piston reaches serviceable limit. 2) Replace the damper rubber ring when the dimension B reaches the serviceable limit. 3) Replace the damper rubber ring when it wears to the extent that the contact surface to the lower piston is reduced to 1/3.

Name of Component	When new	Serviseable limit	Description
Cylinder, for driving the fuel pump	75ϕ +0.03 −0	75.3ϕ	Replace the cylinder when the inner surface wears about 0.3mm.
Piston Ring, for driving the fuel pump	 10mm	 5mm	Replace the piston ring when the flee clearance reaches the serviceable limit.
Outside Dia. of the Piston Ring, for driving the fuel pump.	 3.3±0.1mm	 3.0mm	Replace the piston ring when it wears about 0.3mm
Guide Jaw Guide Gib.			Replace the guide jaw when the clearance between the lead and the guide jaw exceeds 7mm.

8-1 Pile Resista

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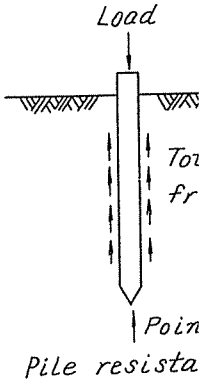


Pile resista

Fig. 8-1

Chapter 8 APPENDIX

8-1 Pile Resistance

The following three formulae are used to calculate the pile penetration resistance.

(1) The determination of the pile penetration resistance with the statical calculation formula.

This formula assumes that the pile penetration resistance is equal to the sum total of the pile point bearing and the skin friction of the pile peripheral surface, according to the soil test results.
(see F. 8-1)

Among the Dole's, Byerbaumer's, Tertzagi's and Meyerhof's formulae, shown here is the Meyerhof's formula with which the bearing force of the pile can be calculated directly using the N value.

$$Q = 43\,NAp + \overline{N}As/5$$

where: Q = pile penetration resistance (ton)
N = standard penetration test value of the pile point
Ap = area of the pile point (m^2)
$\overline{N}$ = average standard penetration test value from the ground surface to the pile point.
As = Spherical area of the pile (m^2)

By using this formula, the relation between the diameter and length of the pile to be driven can be calculated assuming Q to be ultimate hammer driving ability, when the values of N and $\overline{N}$ are known.

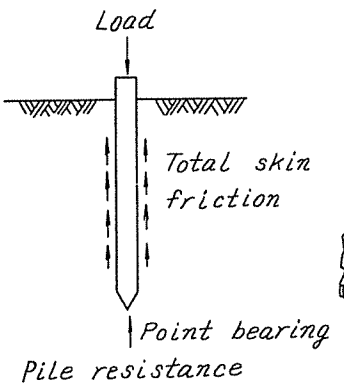


Fig. 8-1

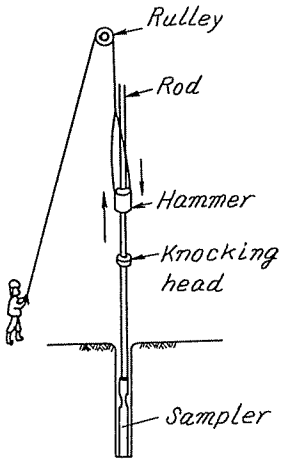
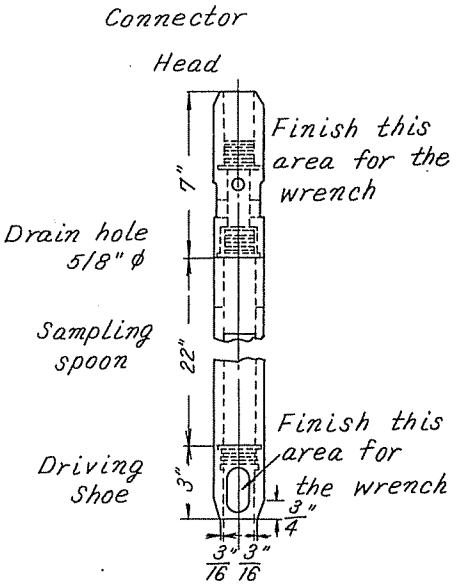


Fig. 8-2



Notes: Standard penetration test N value

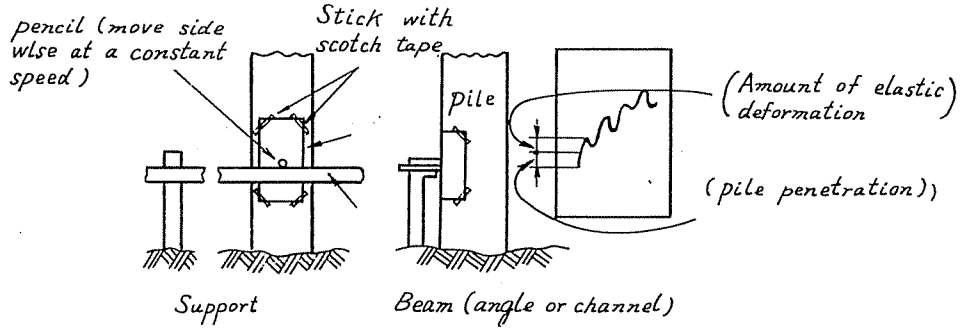
The N value is the number of hammer blows required to drive the knocking head 1 ft. (300 mm) deep into the ground with a 140 lb. (63.5 kg) standard hammer. The hammer dropping height is 30 inches (760 mm).

The rod has the knocking head on the upper end, and on the lower end has the soil test sampler (shown in F., diameter 2 inches (51 mm) length 2 ft. 8 inches, weight 15 lb. (6.8 kg)).

The sampler collects the necessary soil sample for the soil test at the same time.

(2) The calculation of pile penetration resistance with the dynamic formula.

This formula determines the pile resistance by calculating the pile penetration resistance, and is used widely as the test can be performed easily. The Stuttgart University of Technology represents, the formula for calculation of pile resistance for the diesel pile hammers, and Hiley's formula as modified below. This formula is adopted for standard foundation structures by Japan Architectual Association. The allowable bearing force of the pile can be determined by dividing the calculated pile resistance with a safety factor. The standard of the foundation of JAA specifies



F. 8-3 Measuring method of the elastic deformation of the soil and pile

that the safety factor should be 4 for the long term load and 2 for the short term load. In other words, the allowable pile bearing force is 1/4 (long term load) and 1/2 (short term load), of the calculated pile penetration resistance.

$$R = \frac{2WH}{S+K} \cdot \frac{W+n^2P}{W+P}$$

where: R = Pile penetration resistance or bearing force (t)
W = Upper piston weight (t)
H = Falling distance of the upper piston (cm)
S = Penetration depth at the upper piston falling distance H (cm)
P = Pile weight (t)
n = Restitution coefficient (here n = 0)
K = $\pm$, Temporary elastic compression amount of the cushion and pile (cm)

This formula calculates the pile penetration resistance better, by considering the energy loss consumed to the temporary elastic deformation of the soil cushion and pile at the time of the upper piston blow, and enertia of the weight of the pile and upper piston.
S is 1/10 of the pile penetration of the last 10 blows. K is the amount of elastic deformation at the time of pile driving.

(3) The determining pile penetration resistance by the load test method

This is most positive method of determining the pile resistance, however, it requires normally not only a large load but also considerable time and expense. Therefore, this test is usually applied only to special projects.

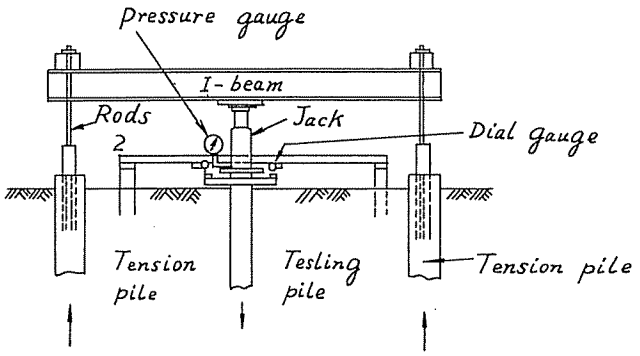


Fig. 8-4

To conduct the test, prepare the supports such as tension piles and apply the load to the test pile with a jack.
Then, determine the ultimate bearing force of the test pile by measuring the sinking amount of the pile. The pile load test device using the tension piles is as shown in F. 8-4.

8-2 Selection of Hammer Capacity

The hammer capacity is determined by considering the following factors.

1) Enertia of the pile (pile weight)
The weight of the upper piston should be more than 1/4 of that of the pile.

2) The soil friction resistance during the driving operation.

3) Elasticity of the pile and the ground.

4) Energy loss during driving.

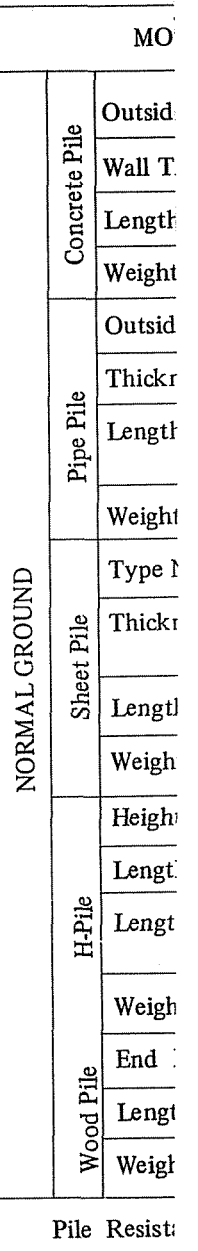
The most accurate selection of the hammer capacity can be made according to the diameter and length of the pile to be driven, the N value of the pile point, and the mean value N of the N value from the ground surface to the pile point. Calculate the pile penetration resistance by using the Meyerhof's formula, and calculate the hammer driving ability by using Hiley's formula. Compare the two results and select the most suitable hammer capacity.

The ratio of the driving energy loss increases as the weight of the pile increases compared to the weight of the upper piston in the pile driving operation. Therefore, it is not recommended to use the pile more than 4 times heavier than the upper piston weight.

In the case of driving piles at an angle, the radio of the driving energy loss will increase as the angle of the hammer increases. When the pile penetration resistance becomes great during the driving operation, the amount of penetration per blow decreases, resulting in the high compression stress on the pile and hammer.

In order to prevent the pile and hammer from damage, determine the penetration resistance by measuring the penetration during the driving operation. Stop the pile driving and make the pile short when the pile penetration resistance reaches the predetermined value.

8-3 Pile Size



8-3 Pile Size Suitable for the IHI Diesel Pile Hammer

MODEL				IDH – J22					
NORMAL GROUND	Concrete Pile	Outside Diameter	mm	400	450		500	600	
		Wall Thickness	mm	70	70		80	100	
		Length	m	8 ~ 15	10 ~ 15		10 ~ 20	10 ~ 15	
		Weight	kg	2,000 ~ 6,000					
	Pipe Pile	Outside Diameter	mm	500			600		
		Thickness	mm	6	9	12	9	12	16
		Length	mm	20 ~ 60	20 ~ 60	15 ~ 45	15 ~ 45	10 ~ 30	10 ~ 30
		Weight	kg	2,000 ~ 6,000					
	Sheet Pile	Type No.		III	IV	V	F	Z45	
		Thickness	mm	13	15.5	22.0	9.5	21.5/12.5	
		Length	m	10 ~ 24	10 ~ 24	10 ~ 24	10 ~ 24	10 ~ 24	
		Weight	kg	2,000 ~ 6,000					
	H-Pile	Height × Width	mm	300 × 300		350 × 350		400 × 400	
		Length	mm	12	16	12	16	12.5	16
		Length	mm	20 ~ 60	20 ~ 60	20 ~ 60	15 ~ 45	15 ~ 45	15 ~ 45
		Weight	kg	2,000 ~ 6,000					
	Wood Pile	End Diameter	mm						
		Length	m						
		Weight	kg						
Pile Resistance			ton	200 ~ 500					

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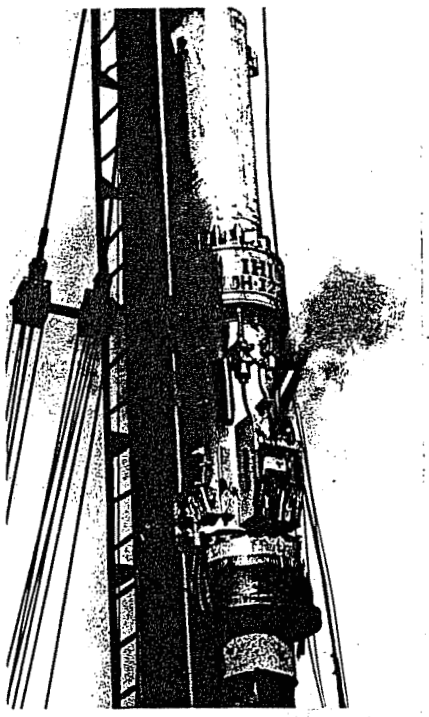
IHI

ディーゼル パイル ハンマ
IDH-J22形
部 品 表
PARTS LIST
FOR
DIESEL PILE HAMMER
MODEL IDH-J22



石川島播磨重工業株式会社

Ishikawajima-Harima Heavy Industries Co., Ltd.

汎 用 機 事 業 部

Mass Produced Machinery Division

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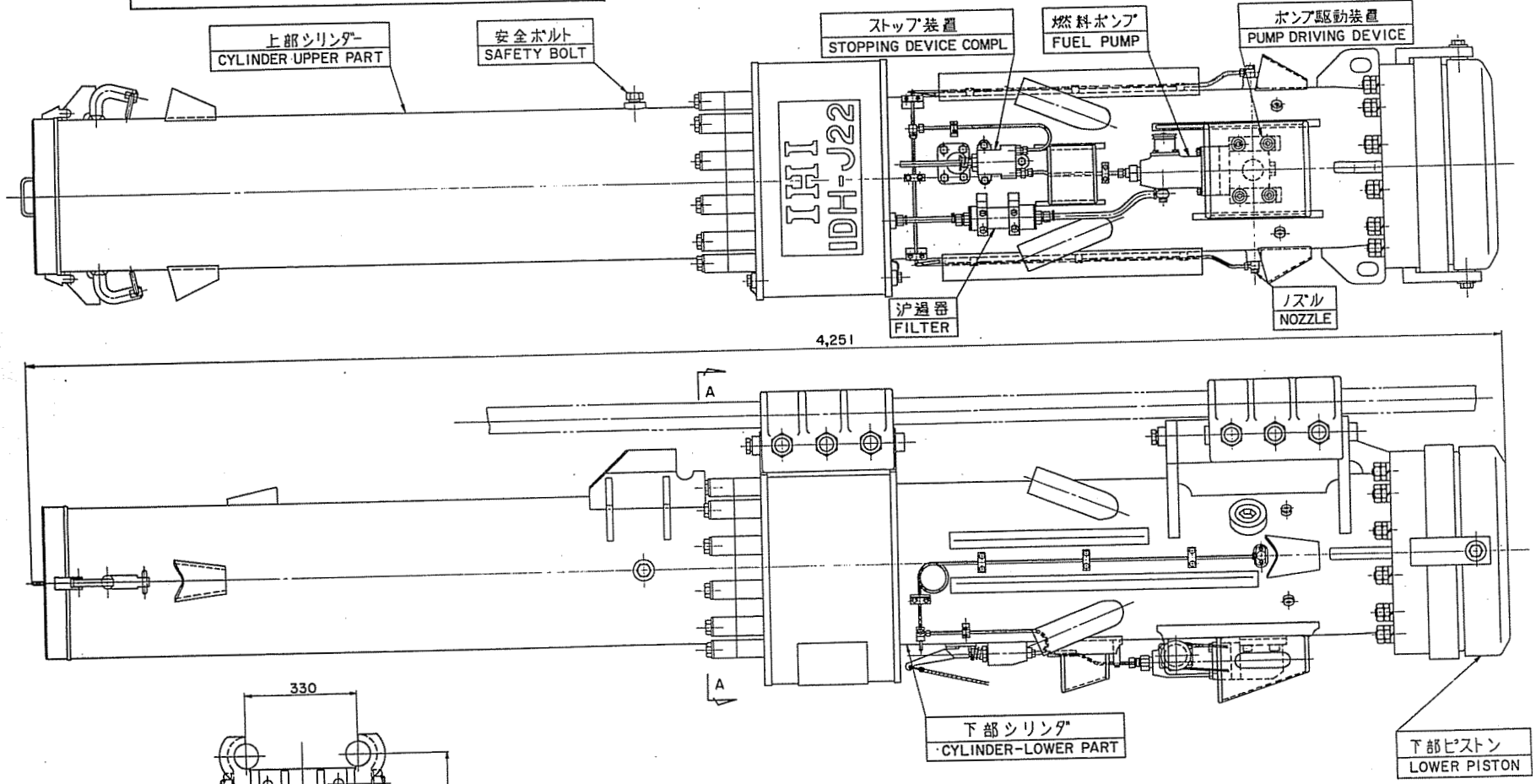
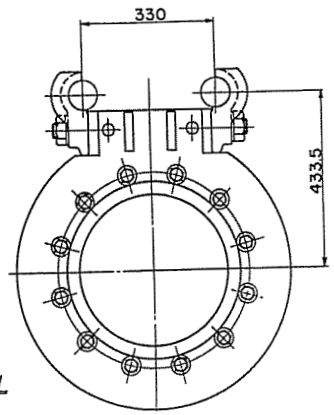
J240100 全 体 組 立
GENERAL ASSEMBLY



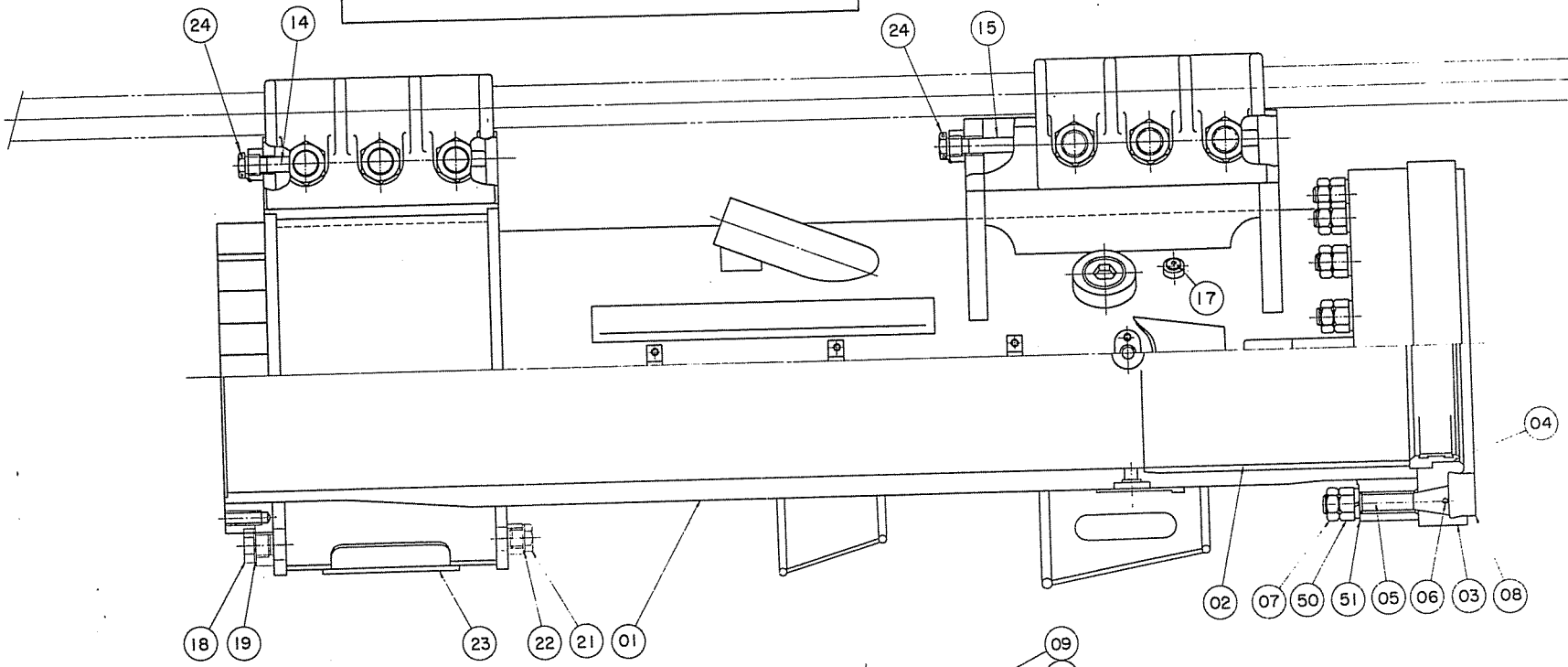


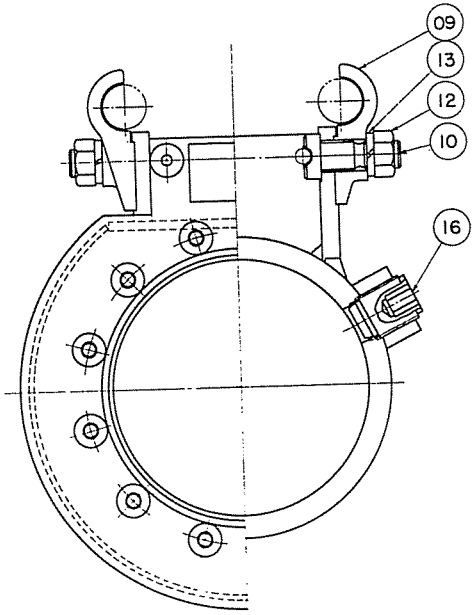
A – A SECTIONAL VIEW

J240100 全体組立 GENERAL ASSEMBLY

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
	J240100	全体組立	GENERAL ASS'Y	1	
	J241000	下部シリンダ	CYLINDER-LOWER PART	1	
	J241100	上部シリンダ	CYLINDER-UPPER PART	1	
	J152000	上部ピストン(ラム)	UPPER PISTON (RAM)	1	
	J242100	下部ピストン(アンビル)	LOWER PISTON (ANVIL)	1	
	J243000	燃料ポンプ	FUEL PUMP	1	
	J243100	燃料ポンプ駆動装置	PUMP DRIVING DEVICE	1	
	J243200	ノズル	NOZZLE	2	
	J243300	ストップ装置	STOPPING DEVICE COMPL.	1	
	J244000	燃料管装置	FUEL LINE COMPL.	1	
	J245000	起動装置	TRIPPING DEVICE COMPL.	1	

J241000 下部シリンダ
CYLINDER-LOWER

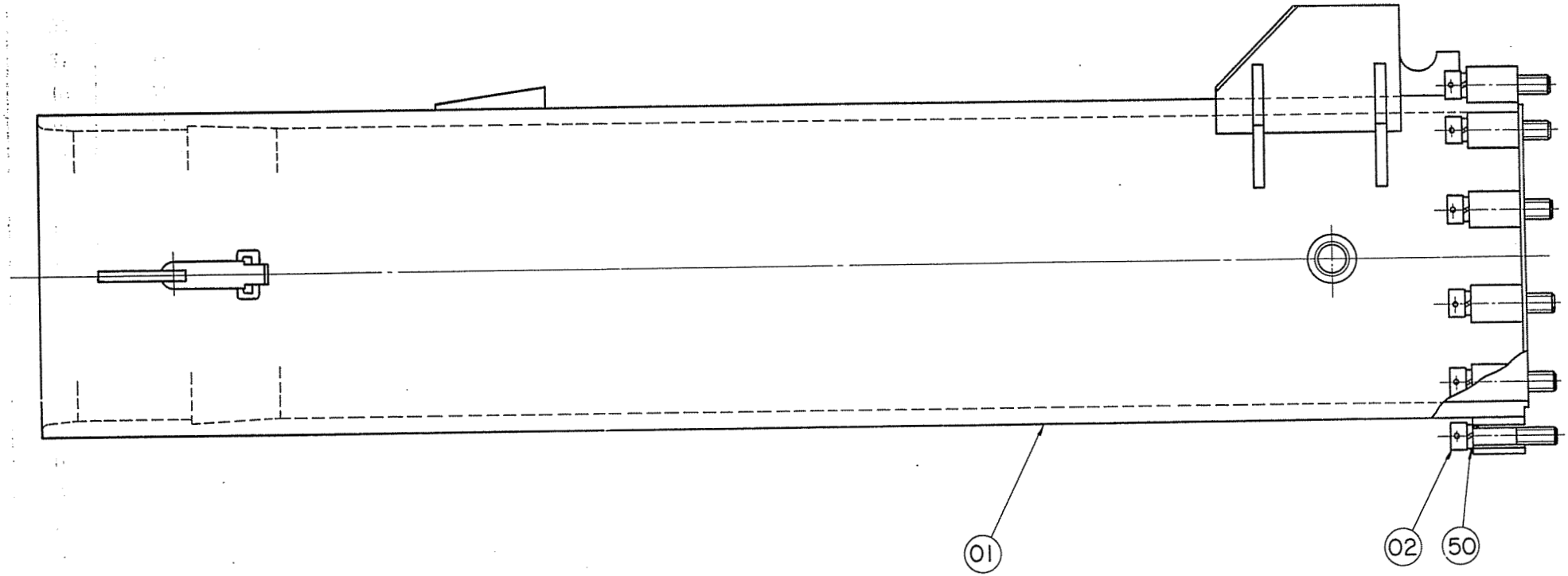




J241000 下部シリンダ CYLINDER-LOWER

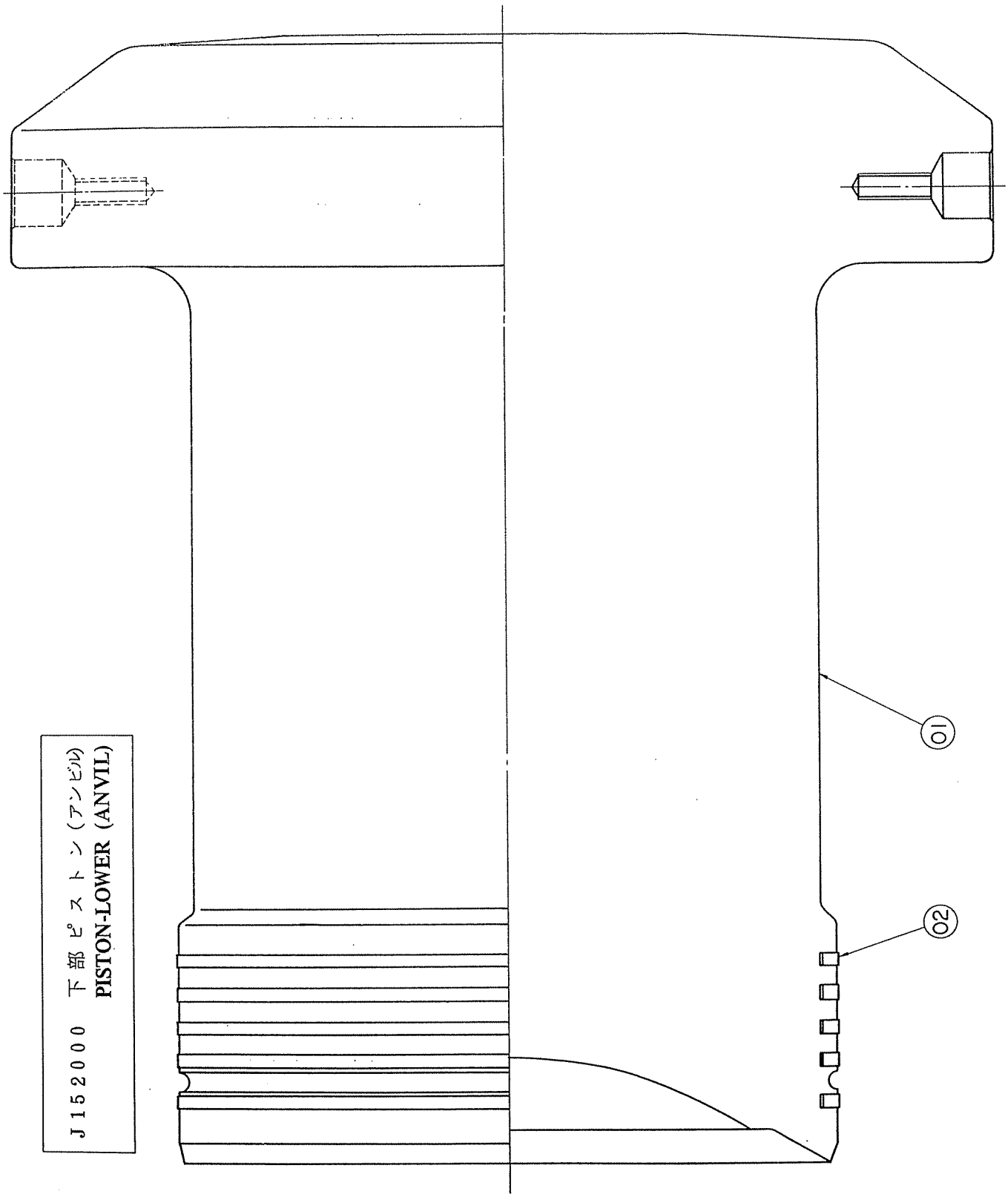
符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
	J241000	ユニット組立品			
01	J241001	シリンダ，下部	CYLINDER, lower	1	
02	J151002	スリーブ，シリンダ	SLEEVE, cylinder	1	
03	J151003	エンドリング，外側	END RING, outer	1	
04	J151004	エンドリング，内側	END RING, inner	1	
05	J151005	ボルト，円錐，M33×207	BOLT, conical, M33 x 207	16	
06	J121008	ピン，円錐ボルト用，8φ×56	PIN, for conical bolt, 8φ x 56	16	
07	J151007	ナット，エンドリング締付，3種	NUT, for end ring locking	16	
08	J151008	ゴム環，緩衝，590φ／430φ×45	RING, rubber, 590φ/430φ x 45	1	
09	J151009	ジョウ，ガイド	JAWS, guide	4	
10	J151010	ボルト，ガイドジョウ，M42×150	BOLTS, jaws, M42 x 150	12	
12	J151012	ナット，ガイドジョウ	NUTS, jaws	12	
13	J151013	バネ座金，ガイドジョウ	WASHER, guide jaws	12	
16	J151016	プラグ，点検用	PLUG, inspection	1	
17	J151017	ニップル，グリース（アンビル用）	NIPPLE, grease (for anvil)	4	
18	J151018	プラグ，燃料補給	PLUG, fuel supply	1	
19	J151019	パッキン（燃料補給プラグ用）	PACKING (for fuel supply plug)	1	
21	J151021	プラグ，ドレン抜	PLUG, for drain	1	
22	J151022	パッキン（燃料タンクドレン抜プラグ用）	PACKING, for drain plug	1	
23	J241023	銘板	NAME PLATE	1	
24	J151024	プラグ，セフティーバー	PLUG, safety bar	4	
50	J151007	ナット，六角，1種2級，M33×2	NUT, hex., M33 x 2	12	JIS B 1181 エンドリング用
51	J141054	バネ座金，33S	WASHER, 33S	12	JIS B 1251 (for end ring)
14	J241014	セフティーバー	SAFETY BAR	2	
15	J241015	セフティーバー	SAFETY BAR	2	

J241100　上部シリンダ
CYLINDER-UPPER



J241100 上部シリンダ CYLINDER-UPPER

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
	J241100	ユニット組立			
01	J241101	シリンダ，上部	CYLINDER, upper	1	
02	J151102	ボルト，上部下部シリンダ締付	BOLT	12	
50	J141052	ばね座金，2号，24S	WASHER, spring, 24S	12	JIS B 1251

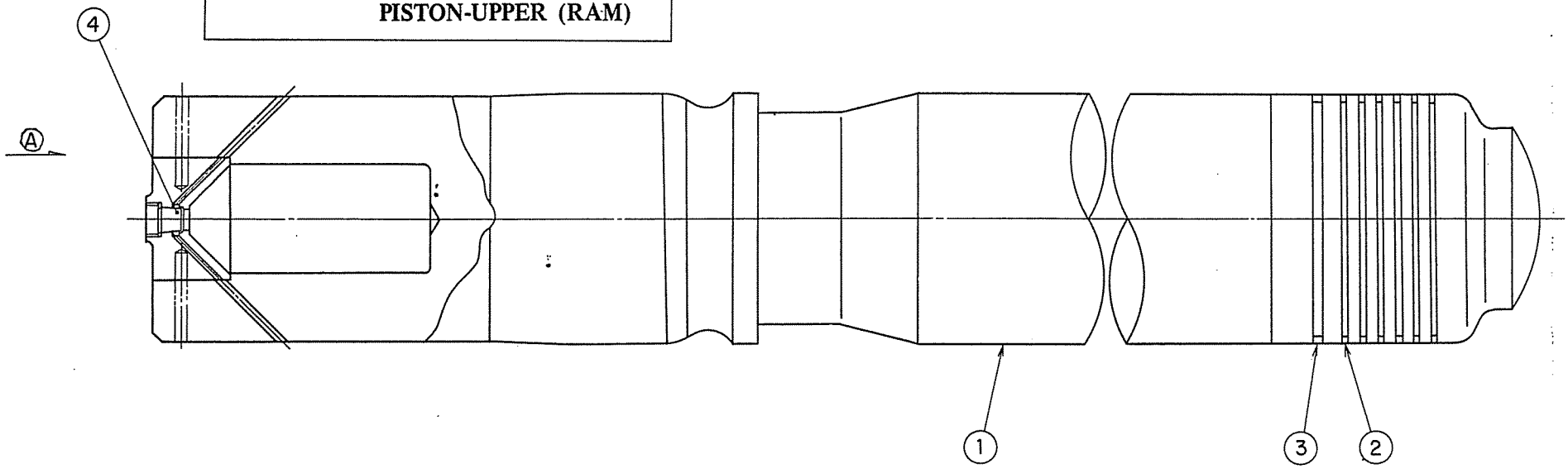


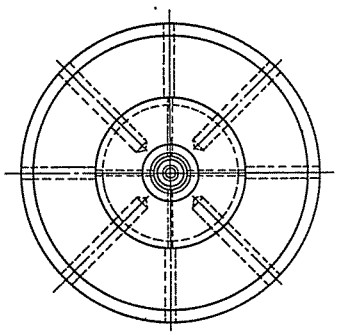
J1520000 下部ピストン（アンビル）
PISTON-LOWER (ANVIL)

J152000 下部ピストン（アンビル） PISTON-LOWER (ANVIL)

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
	J152000	ユニット組立品		1	
01	J152001	ピストン 下部	PISTON, lower	1	
02	J122004	リング，ピストン	RING, piston	5	

J242100 上部ピストン（ラム）
PISTON-UPPER (RAM)





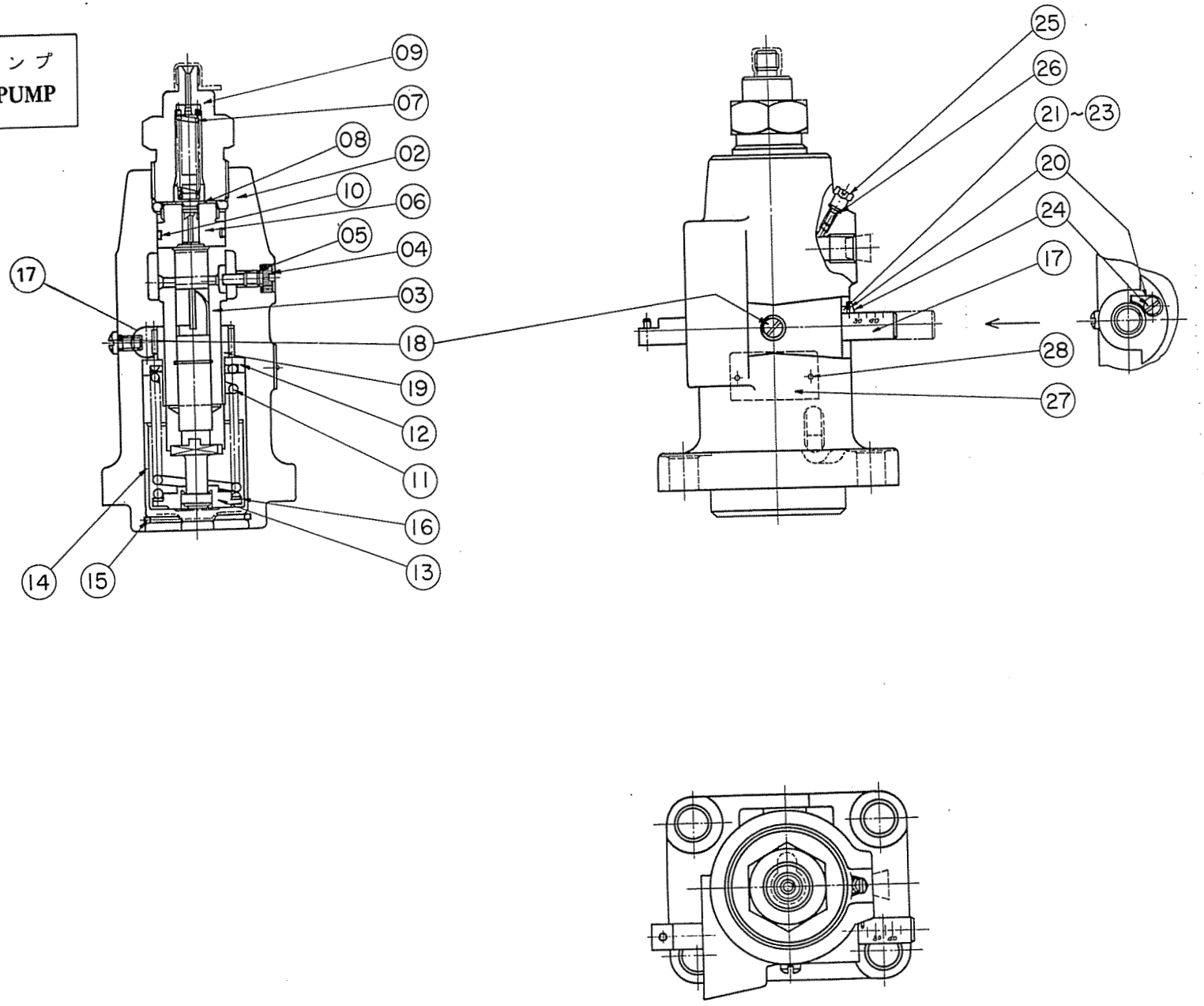
Ⓐ カラ見ル
VIEW FROM (A)

VIEW FROM (A)

J242100　上部ピストン（ラム）　PISTON-UPPER (RAM)

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
	J242100	ラムユニット組立品			
01	J242101	ラム	RAM (PISTON-upper)	1	
02	J122004	リング，ピストン	RING, piston	6	
03	J122106	リング，キャッチ	RING, catch	1	
04	J152104	プラグ，オイラー	PLUG, oiler	1	

J243000 燃料ポンプ
FUEL PUMP

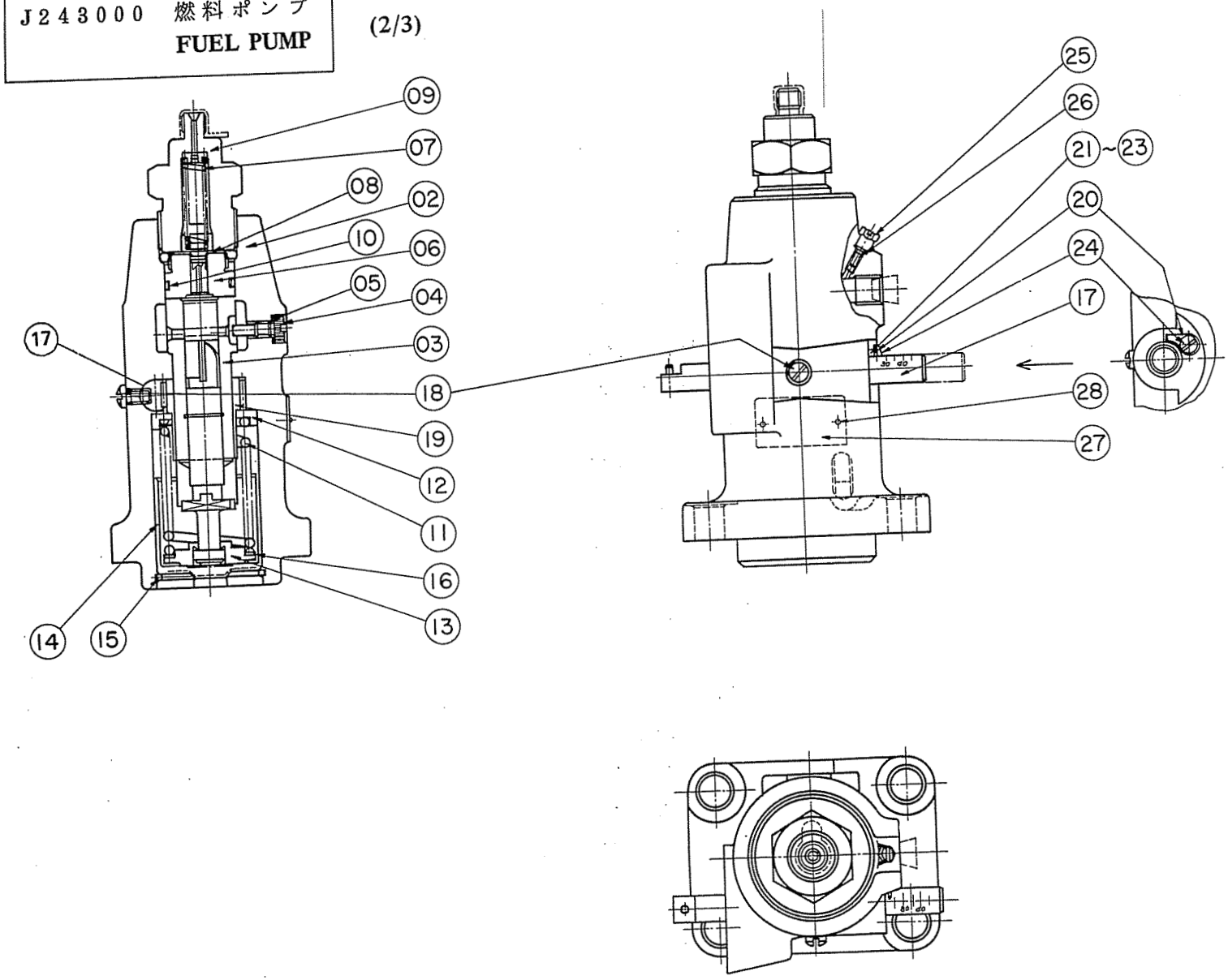


J243000 燃料ポンプ FUEL PUMP (1/3)

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
	J243000	燃料ポンプ組立図			
02	J243002	ハウジング，ポンプ	HOUSING, fuel pump	1	
03	J243003	プランジャアセンブリ	PLUNGER ASS'Y	1	
04	J243004	デフレクタ	DEFLECTOR	1	
05	J243005	ガスケット	GASKET	1	
06	J243006	デリバリバルブアッセンブリ	DELIVERY VALVE ASSE'Y	1	
07	J243007	スプリング，バルブ	SPRING, valve	1	
08	J243008	ガスケット，デリバリバルブ	GASKET, delivery valve	1	
09	J243009	ホルダ，デリバリバルブ	HOLDER, delivery valve	1	
10	J243010	Oリング	O-RING	1	
11	J243011	スプリング，プランジャ	SPRING, plunger	1	
12	J243012	シート，スプリング（上用）	SEAT, spring (upper)	1	
13	J243013	シート，スプリング（下用）	SEAT, spring (lower)	1	
14	J243014	ガイド，プランジャ	GUIDE, plunger	1	
15	J243015	スナップリング	SNAP RING	1	
16	J243016	ガスケット	GASKET	1	
17	J243017	ラック，コントロール	RACK, control	1	
18	J243018	スクリュ，ラックガイド	SCREW, rack guide	1	
19	J243019	スリーブ，コントロール	SLEEVE, control	1	
20	J243020	ポインタ	POINTER	1	
21	J243021	シム	SIM		必要に応じて使用 use if necessary
22	J243022	シム	SIM		
23	J243023	シム	SIM		

J243000 燃料ポンプ
FUEL PUMP

(2/3)

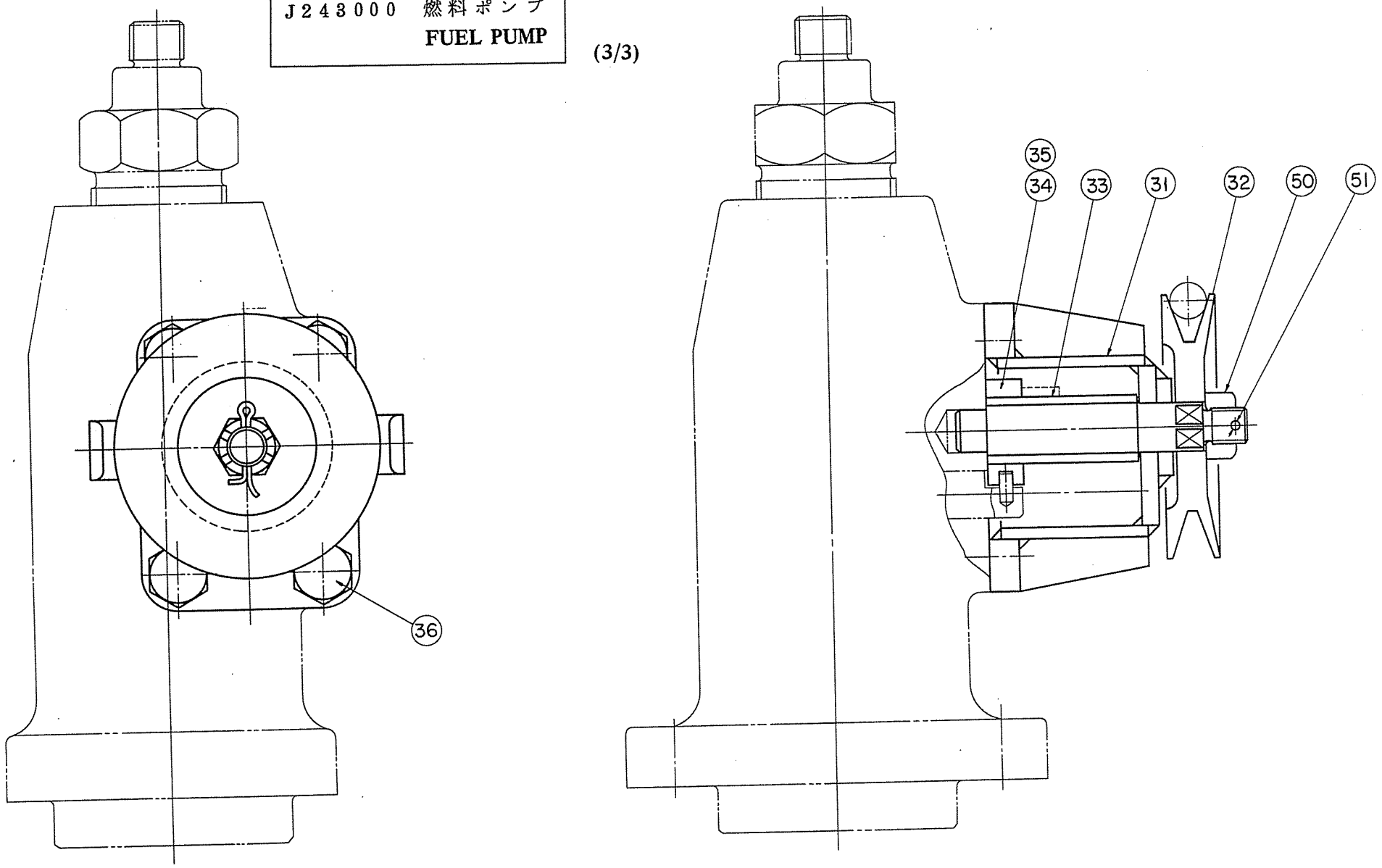


J243000 燃料ポンプ FUEL PUMP (2/3)

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
24	J243024	ネジ	SCREW	1	
25	J243025	ネジ，空気抜	SCREW, air bleeding	1	
26	J243026	ガスケット	GASKET	1	
27	J243027	ネームプレート	NAME PLATE	1	
28	J243028	ネール	NAIL	2	

J243000 燃料ポンプ
FUEL PUMP

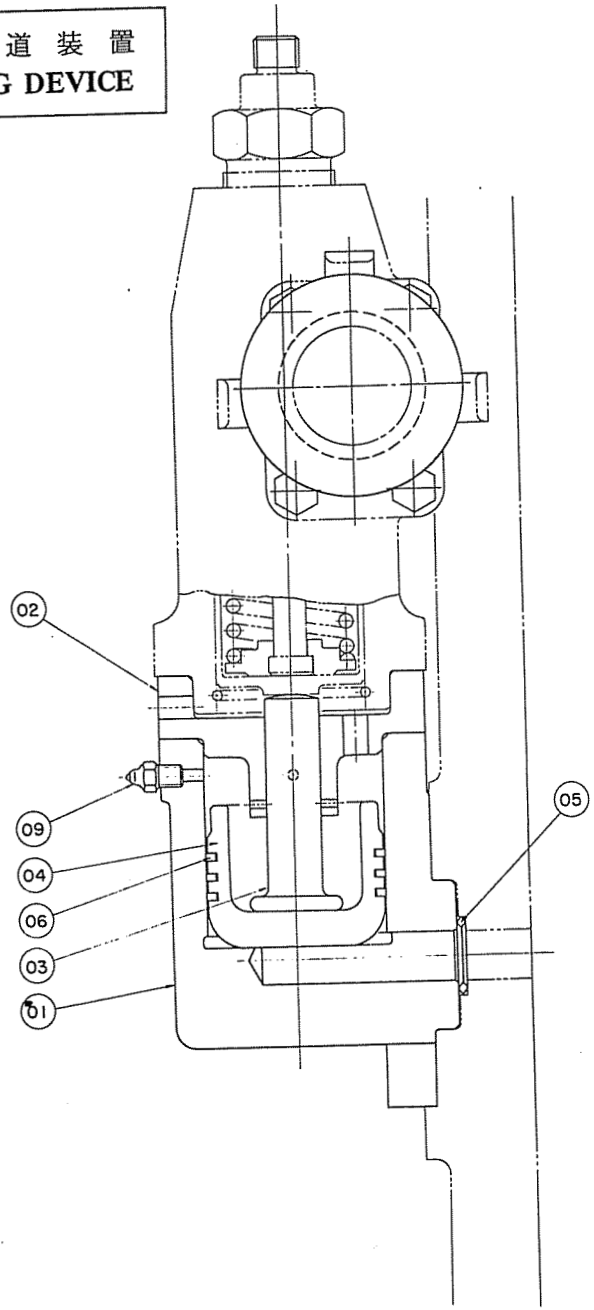
(3/3)

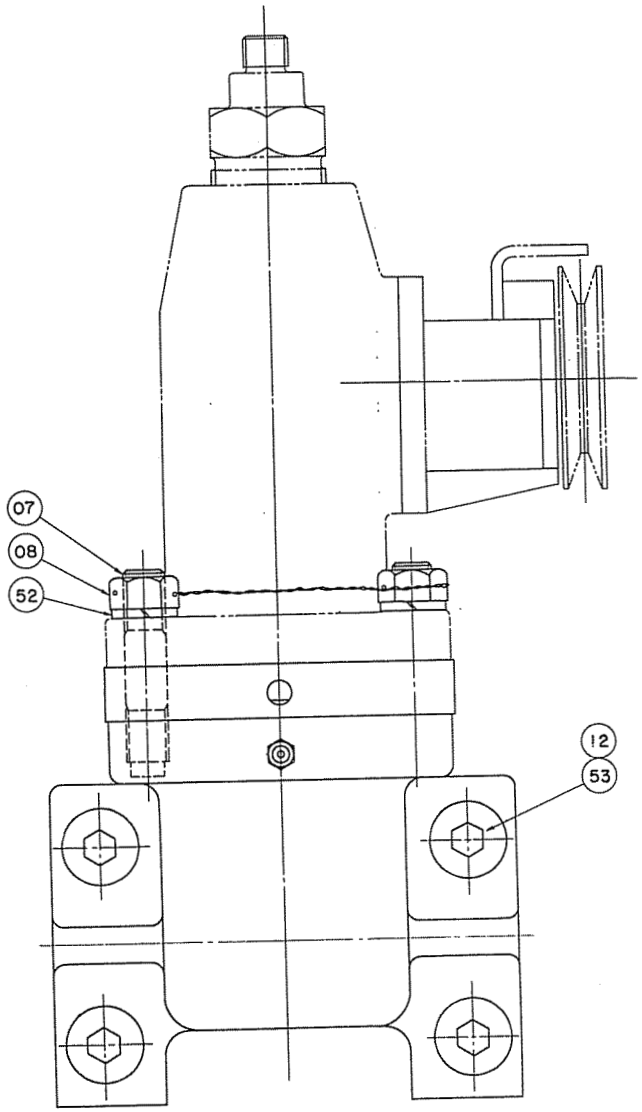


J243000 燃料ポンプ FUEL PUMP (3/3)

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
30	J243030	燃料ポンプ調整機構アッセンブリ	FUEL SUPPLY REGULATING DEVICE ASS'Y		
31	J243031	軸受箱	BEARING BOX	1	
32	J243032	プーリ	PULLEY	1	
33	J243033	スピンドル	SPINDLE	1	
34	J243034	カラー（A形）	COLLAR (type A)	1	
35	J243035	カラー（B形）	COLLAR (type B)	1	
36	J243036	ボルト，円錐	BOLT, conical	4	
50	J243050	ナット，ミゾ付，1種，M12×1.75	NUT, M 12 x 1.75	1	JIS B 1170
51	J243051	ピン，テーパ，3×28	PIN, tapered. 3 x 28	1	JIS B 1353

J243100 ポンプ駆道装置
PUMP DRIVING DEVICE

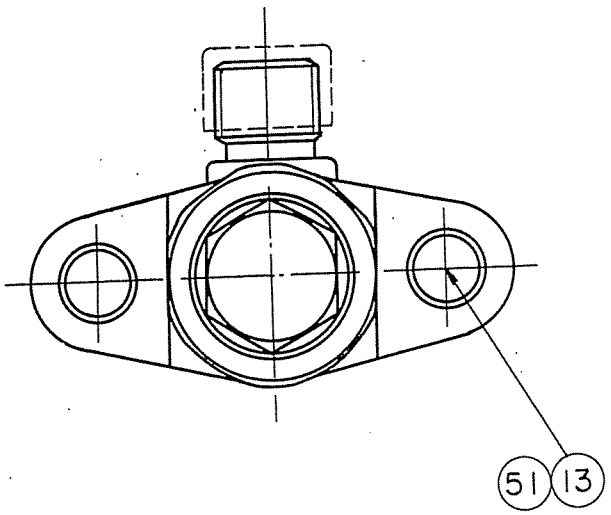


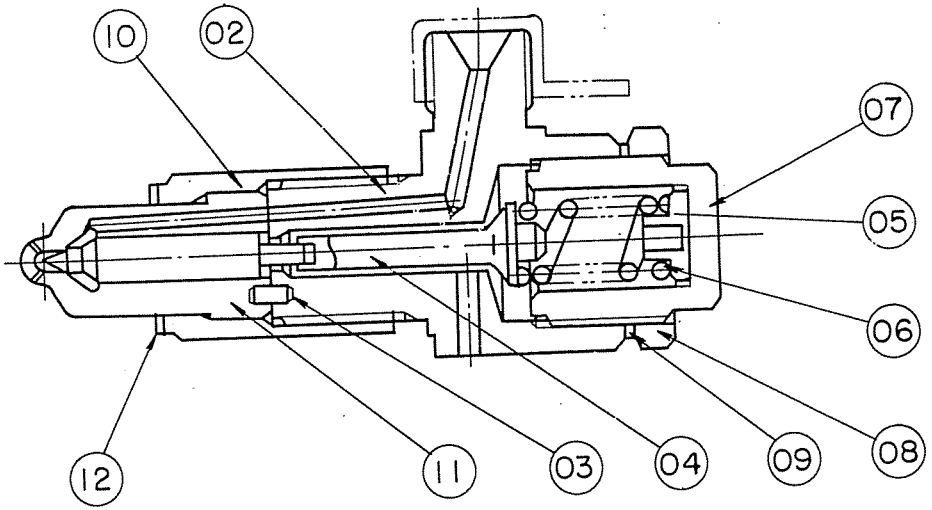


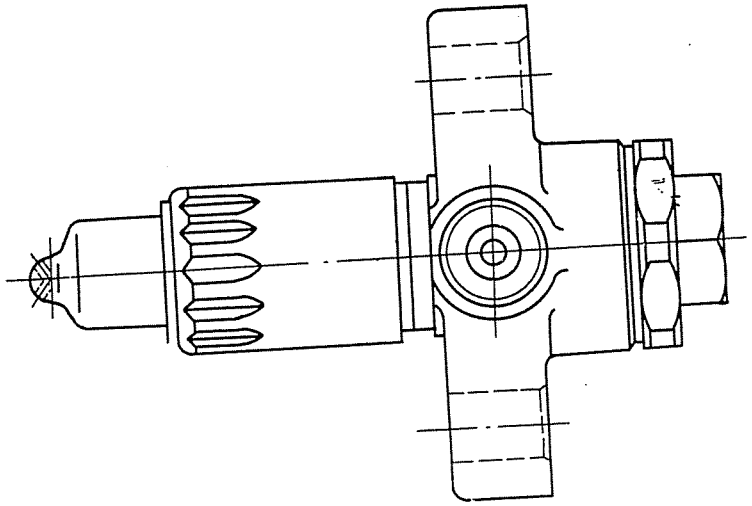
J243100　ポンプ駆動装置　PUMP OPERATING DEVICE

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
	J243100	ユニット組立			
01	J243101	シリンダ，ポンプ駆動用	CYLINDER, for pump driving	1	
02	J243102	フランジ，ポンプ取付	FL ANGE, for pump fitting	1	
03	J243103	ロッド，ピストン	ROD, piston	1	
04	J243104	ピストン	PISTON	1	
05	J243105	ガスケット	GASKET	1	
06	J243106	リング，ピストン，75φ×3.0	RING, piston, 75Φ x 3.0	3	
07	J243107	ボルト，植込，M16	BOLT, stud, M16	4	
08	J243108	ナット，ポンプ取付用(M16×1.5)	NUT, for pump fitting (M 16 x 1.5)	4	
09	J151017	ニップル，グリース	NIPPLE, grease	1	
12	J243112	ボルト，ポンプ取付	BOLT, for pump fitting	4	
52	O459019	バネ座金，16	WASHER, spring, 16	4	
53	J243153	サラバネ座金，20	WASHER, spring, 20	4	

J243200 ノズル
NOZZLE



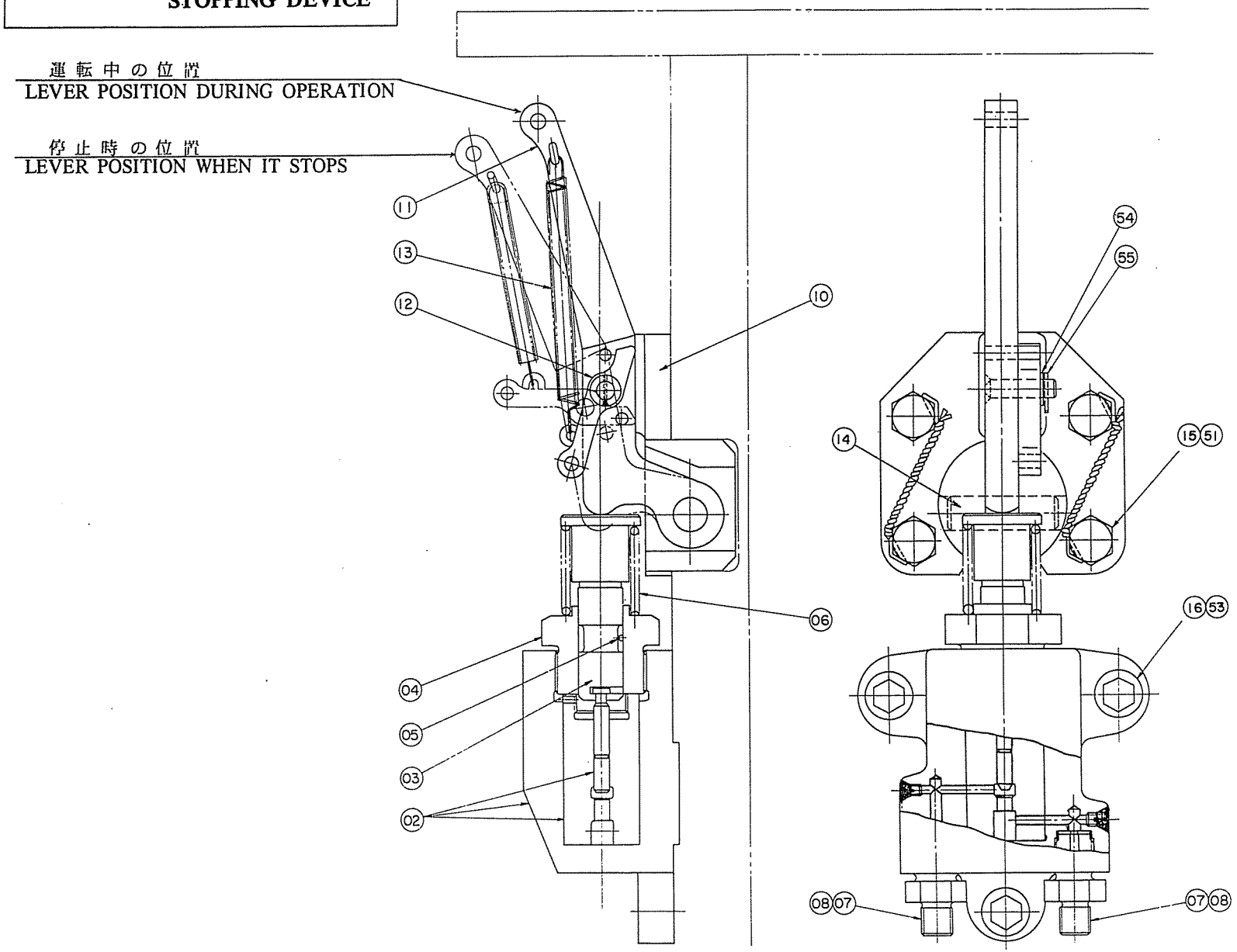




J243200 ノズル NOZZLE

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
	J243200	ユニット組立品		2 sets	
02	J243202	ノズルホルダーボディ	BODY, nozzle holder	2	
03	J243203	ピン，ダウエル	PIN, dowel	4	
04	J243204	ロッド，プッシュ	ROD, push	2	
05	J243205	シート，スプリング	SEAT, spring	2	
06	J243206	スプリング	SPRING	2	
07	J243207	ネジ，調整	SCREW, adjusting	2	
08	J243208	ナット，ロック	NUT, lock	2	
09	J243209	座金，ロックナット	WASHER, for lock nut	2	
10	J243210	ナット，ノズルチップ取付	NUT, nozzle tip fitting	2	
11	J243211	ノズルチップ	NOZZLE TIP	2	
12	J243212	座金，ノズル先端	GASKET, nozzle tip	2	
13	J243213	ボルト，ノズルホルダ取付	BOLT, for nozzle holder fitting	4	
51	J243251	サラバネ座金，10	WASHER, spring, 10	4	

J243300 ストップ装置
STOPPING DEVICE

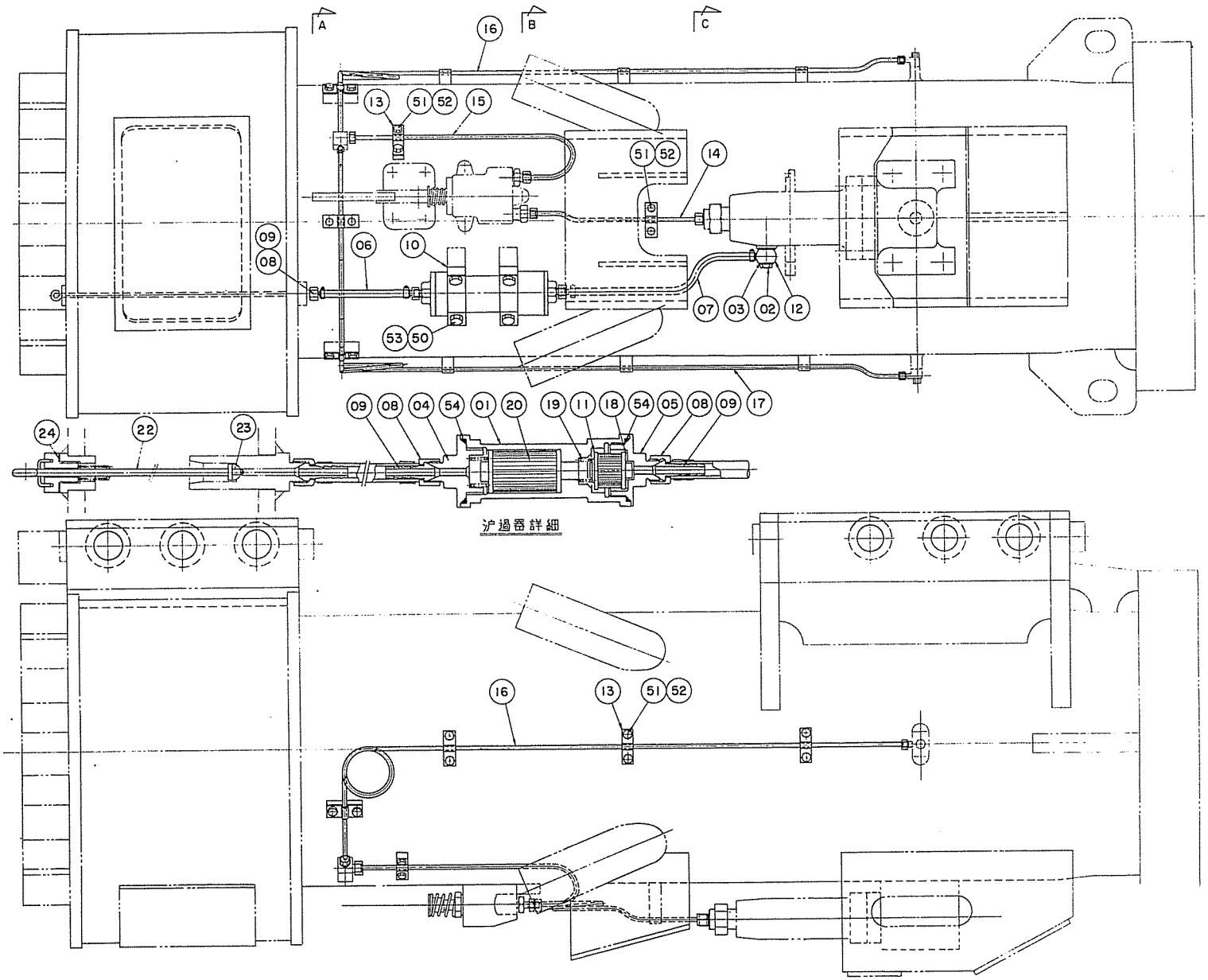


J243300 ストップ装置 STOPPING DEVICE

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
	J243300	ストップ装置ユニット組立			
	J243301	ストップ弁アッセンブリ	STOP VALVE ASS'Y	(1)	
02	J243302	ストップ弁本体	VALVE, stop	1	
03	J243303	ロッド，プッシュ	ROD, push	1	
04	J243304	ナット，ロック	NUT, lock	1	
05	J243305	ピン，ロール	PIN, roll	1	
06	J243306	スプリング，リターン	SPRING, return	1	
07	J243307	ニップル	NIPPLE	2	
08	J243308	ガスケット	GASKET	2	
10	J243310	ボス，レバー用	BOSS, for lever	1	
11	J243311	レバー	LEVER	1	
12	J243312	爪	PAWL	1	
13	J243313	バネ	SPRING	1	
14	J243314	軸，レバー用	AXIS, for lever	1	
15	J243315	ボルト，レバー用ボス取付	BOLT, for fitting boss	4	
16	J243316	ボルト，ストップ弁本体取付	BOLT, for fitting stop valve body	3	
51	O459028	バネ座金，3号，12S	WASHER, spring, 12S	4	
53	J243353	さらばね座金，M14	WASHER, M14	3	
54	O451063	平座金（ミカキ丸）2種 M10	WASHER, M10	1	
55	J243355	ピン，テーパー，3×25	PIN, tapered. 3 x 25	1	
	J243360	ストップレバー完備品	STOP LEVER COMPL.	(1)	

J244000 燃料管装置
FUEL LINE COMPL.

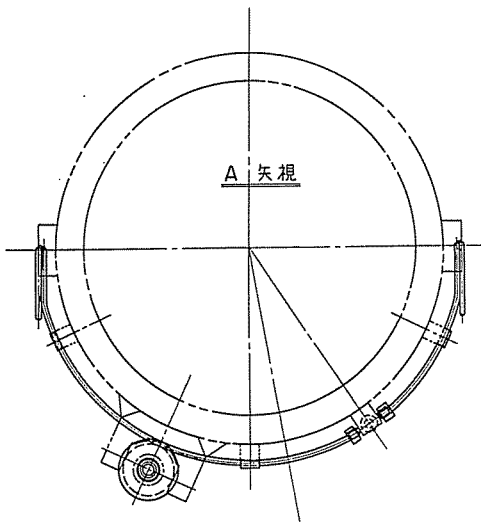
(1/2)

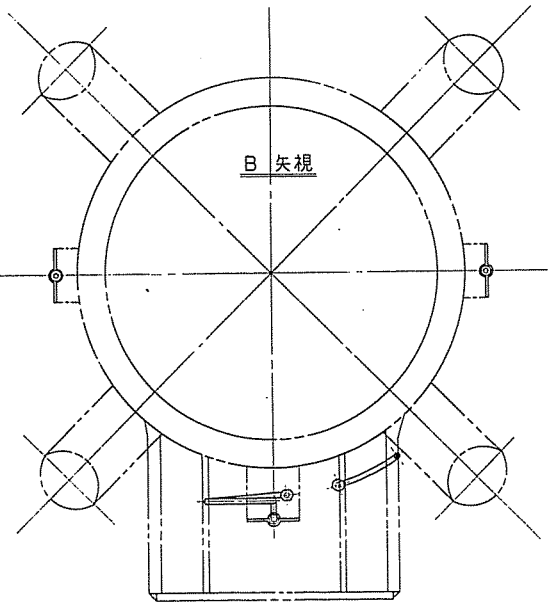


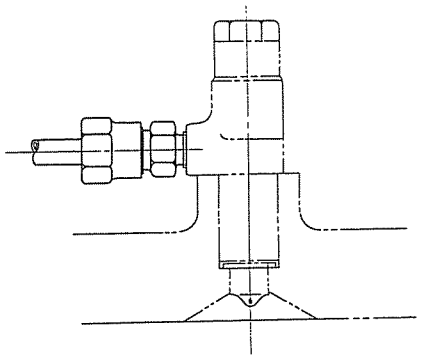
FUEL LINE COMPL.

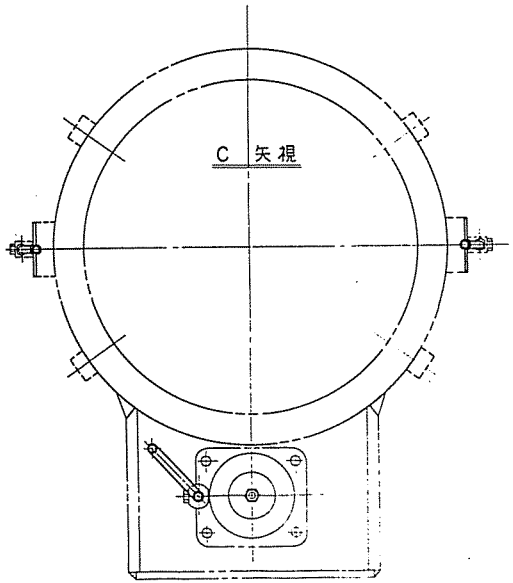
符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
	J244000	ユニット組立			
01	J244001	沪過器ボディー	FILTER BODY	1	
02	J244002	ボルト，コネクタ（燃料ポンプ用）	BOLT, connector, (for fuel pump)	1	
03	J244003	パッキン，コネクタバルト用	PACKING, for connector bolt	2	
04	J244004	ユニオン，ネジ込み（吸入側）	UNION, screw (suction side)	1	
05	J244005	ユニオン，ネジ込み（吐出側）	UNION, screw (delivery side)	1	
06	J244006	ゴムホース	HOSE, rubber	1	
07	J244007	ゴムホース	HOSE, rubber	1	
08	J244008	ユニオンナット	NUT, union	3	
09	J244009	ニップル	NIPPLE	3	
10	J244010	金具，沪過器押え	BRACKET, for filter fitting	2	
11	J244011	エレメント，フィルタ	ELEMENT, filter	1	
12	J244012	メガネユニオン	UNION	1	
13	J244013	バンド，管押え	BAND, for pipe holding	11	
14	J244014	鋼管（A）	PIPE (A)	1	
15	J244015	鋼管（B）	PIPE (B)	1	
16	J244016	鋼管（C）	PIPE (C)	1	
17	J244017	鋼管（D）	PIPE (D)	1	
18	J244018	パッキン，ゴム（エレメント用）	PACKING, rubber (for element)	1	
19	J244022	バネ，エレメント押え	SPRING, for element holding	1	
20	J134026	沪過器，燃料油	FUEL FILTER	1	
21	J134020	ゴム板，管保護用	RUBBER PLATE, for pipe protecting	11	
22	J244021	スピンドル，ロッキング	SPINDLE, for locking	1	
23	J124004	ゴムバルブ，ロッキングスピンドル	RUBBER VALVE, locking spindle	1	
24	J164010	パッキン	PACKING	1	

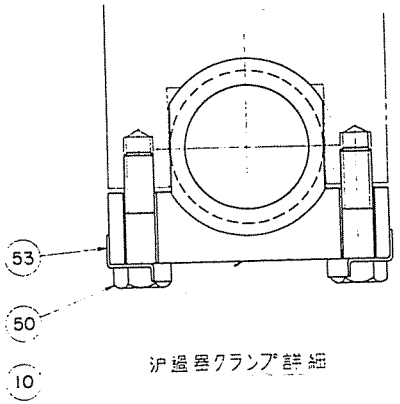
J244000 燃料管装置
FUEL LINE COMPL.



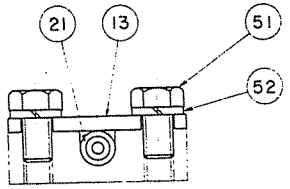




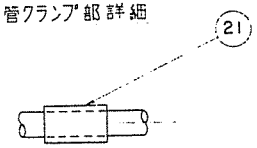




沪過器クランプ詳細



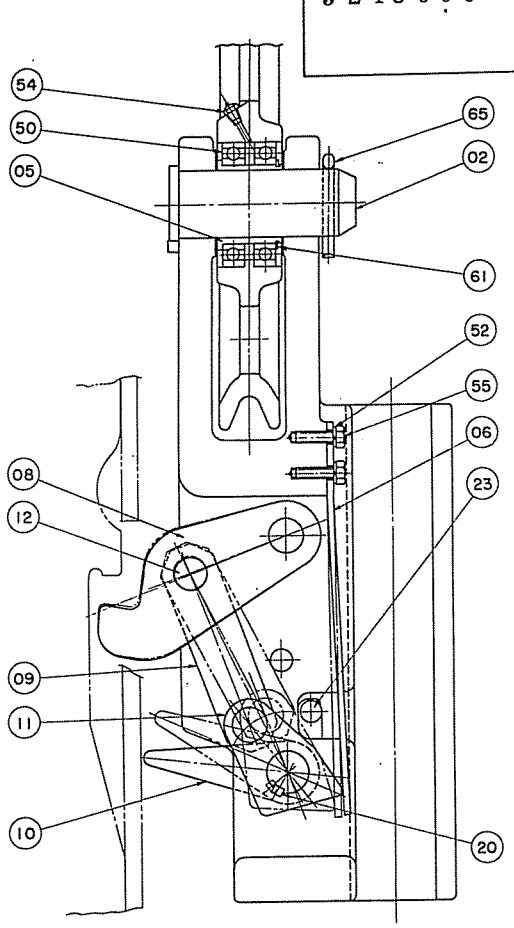
鋼管クランプ部詳細

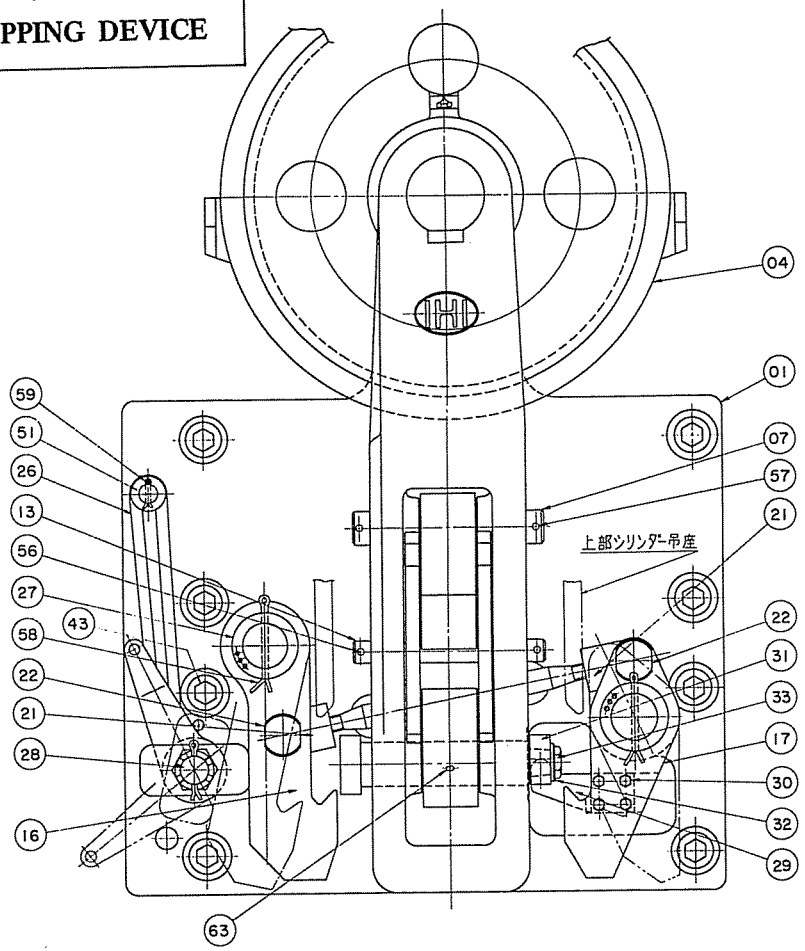


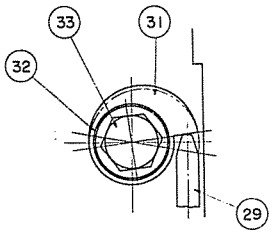
J244000 燃料管装置 FUEL LINE COMPL.

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
50	J164052	ボルト，六角，M12×45	BOLT, hex., M 12 x 45	4	
51	J154052	ボルト，六角，M12×20	BOLT, hex., M 12 x 20	22	
52	O459028	バネ座金，M12	WASHER, spring, M 12	22	
53	J244053	座金	WASHER	4	
54	J133506	Oリング，1種，AG65	O-RING, AG65	2	

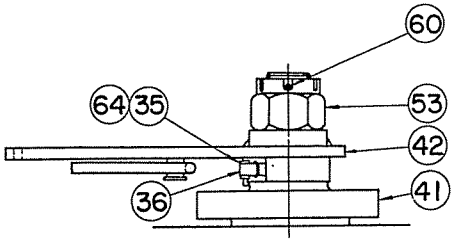
J245000 起動装置
TRIPPING DEVICE



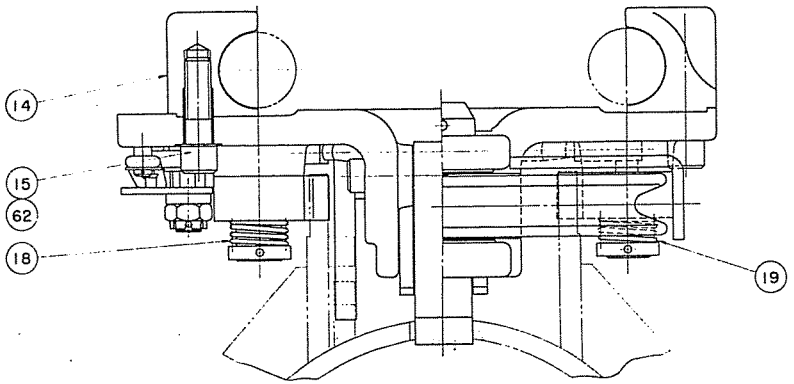




カム部
CAM



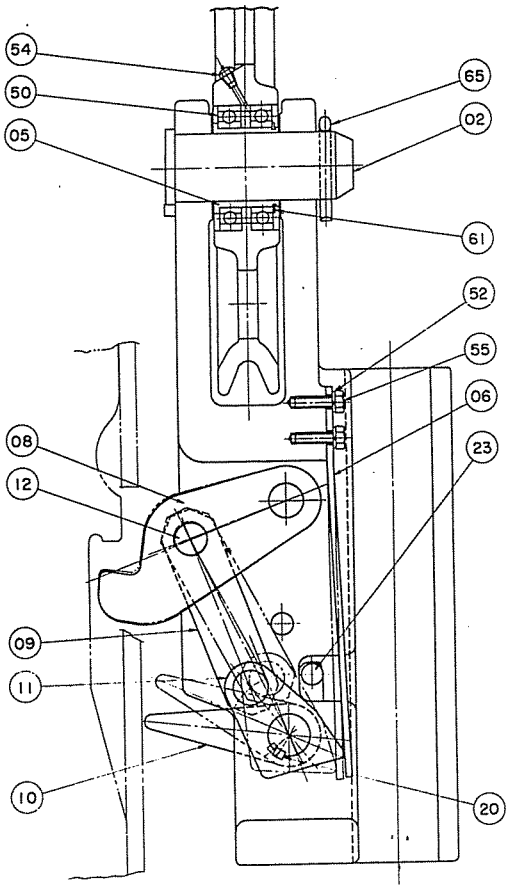
ラチェット部
RATCHET

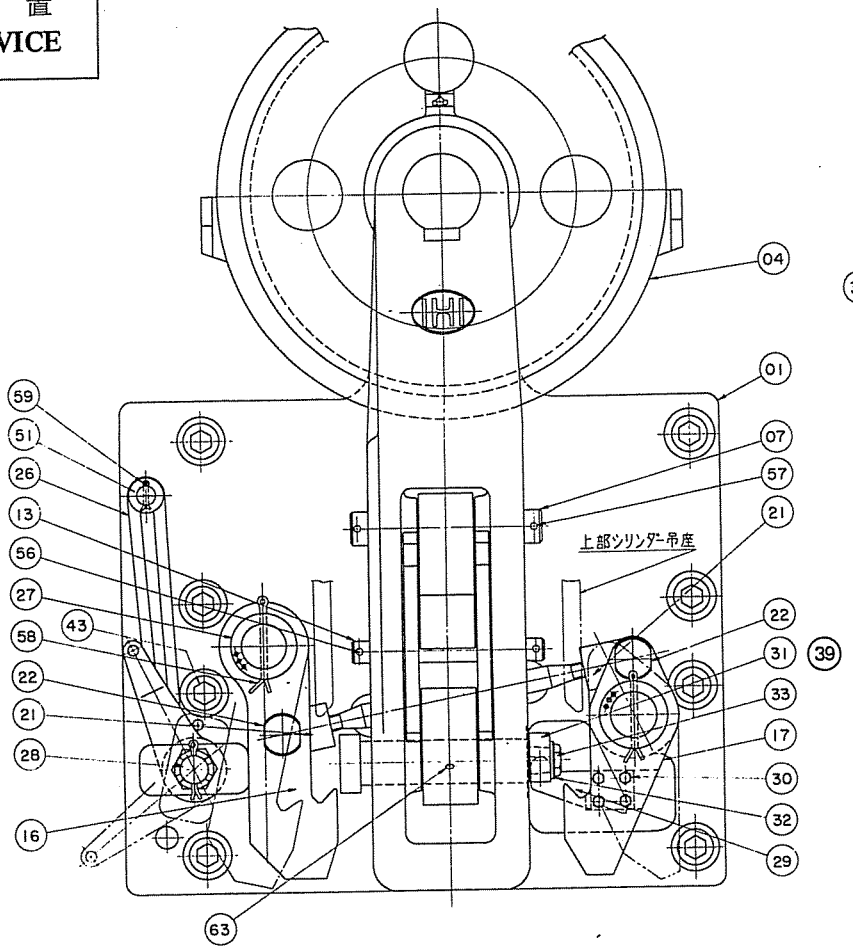


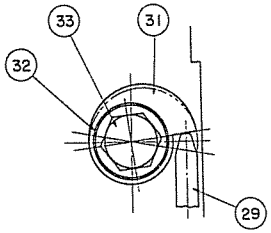
J245000 起動装置 TRIPPING DEVICE (1/3)

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
				1	
01	J245001	ガイドボディ	GUIDE BODY	1	
02	J155002	シーブ軸，70φ×165	Shaft, pulley, 70φ x 165		
				1	
04	J155004	シーブ，400φ×58	Pulley, 400φ x 58	1	
05	J155005	ブッシュ，80／60φ×58	BUSH, 80/60φ x 58	1	
06	J125011	板バネ，6t×60×350	SPRING, plate, 6t x 60 x 350	1	
07	J125014	ボルト，ジョイント，30φ×165	BOLT, joint, 30φ x 165	1	
08	J125016	ポール，45t×104×216	PAWL, 45t x 104 x 216	2	
09	J245009	フィッシュプレート，15t×49×192	FISHPLATE, 15t x 49 x 192	1	
10	J245010	レバー，トリッピング	LEVER, tripping	1	
11	J245011	カム，トリッピング，45×70.5×125	CAM, tripping, 45 x 70.5 x 125	2	
12	J125018	ボルト，ジョイント，30φ×78	BOLT, joint, 30φ x 78	1	
13	J115068	ボルト，ストップ20φ×165	BOLT, stop, 20φ x 165	2	
14	J155014	ギブ，ガイド94×80×440	GIB, guide, 94 x 80 x 440	7	
15	J155015	ボルト，ガイドギブ，M24×104	BOLT, guide gib, M24 x 104	1	
16	J245044	フック，レフト，65×103×252	HOOK, left, 40 x 103 x 252	1	
17	J245045	フック，レフト，40×103×215	HOOK, right, 40 x 103 x 215	1	
18	J125031	戻しバネA，4φ×47.5（レフトフック用）	SPRING A, return (left hook), 4φ x 47.5	1	
19	J125053	戻しバネB4φ×47.5（ライトフック用）	SPRING B, return (right hook), 4φ x 47.5	1	
20	J245020	沈みキー10×8×40	KEY, 10 x 8 x 40	2	
21	J245021	スレッドピース22×40×55	PIESE, thread, 22 x 40 x 55	2	
22	J245022	ボルト，スレッドピース，M22×75	BOLT, thread piese, M22 x 75		

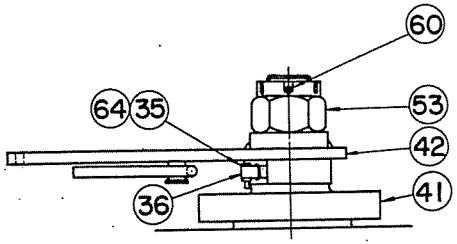
J245000 起 動 装 置
TRIPPING DEVICE



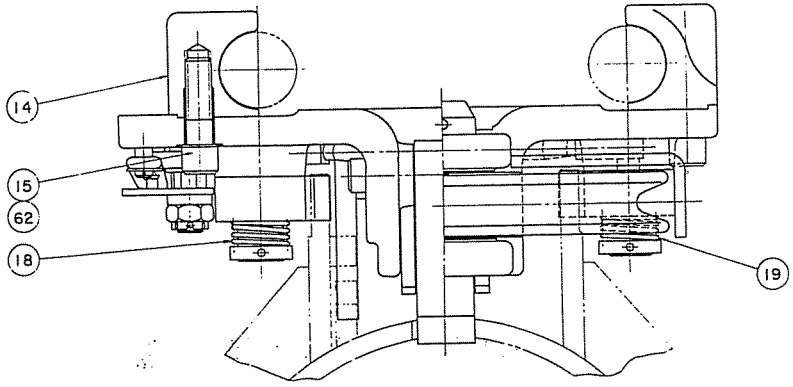




カム部
CAM



ラチェット部
RATCHET



J245000 起動装置 TRIPPING DEVICE (2/3)

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
23	J245023	ロッド，コネクチング，19φ×29.5	ROD, connecting, 19φ x 29.5	1	
26	J115035	戻しゴム10φ×136	RUBBER, return, 10φ x 136	1	
27	J155027	リング，バネ止メ	RING, for spring stopping	2	
28	J155028	スピンドル，ラチェット	SPINDLE, ratchet	1	
29	J245029	カム，ライトフック，40×48×91	CAM, right hook, 40 x 48 x 91	1	
30	J245030	ボルト，M6×45	BOLT, M 10 x 45, M10 x 45	4	
31	J245046	カム，19×49	CAM, 19 x 49	1	
32	J245032	エンドプレート，3t×34φ	PLATE, end, 3t x 34φ	1	
33	J245033	ボルト，締付，27.7×21	BOLT, 27.7 x 21	1	
34	J245041	デバイス，ロッキング	DEVICE, locking	1	
35	J245035	バネ，ねじり	SPRING, torsion	1	
36	J245036	爪	PAWL	1	
37	J245042	ラチェット	RATCHET	1	
	J245038	ラチェット完備品	RATCHET COMP.	(1)	
39	J245039	キー	KEY	1	
43	J245043	六角穴付ボルト	BOLT, hex.	1	

J245000 起動装置 TRIPPING DEVICE (3/3)

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
50	J125008	玉軸受，ラジアル，NO6014Z	BALL BEARING, radial,	2	NO6014Z
51	J155051	平座金黒丸M14	WASHER, M14	1	
52	O459015	バネ座金2号10（板バネ用）	WASHER, (for plate spring)	4	
53	J155053	溝付ナット高形M24×3	NUT, M24 x 2	1	
54	J145057	グリスニップルA－PT¼	NIPPLE, grease, A–PT¼	1	
55	J145063	中2級ボルトM10×25	BOLT, M10 x 25	4	
56	O461821	割ピン5×30（ストップピン用）	PIN, split (for stop pin), 5 x 30	2	
57	J125064	割ピン6×55（ポール軸用）	PIN, split (for pawl axis), 6 x 55	2	
58	O461850	割ピン8×80（フック軸用）	PIN, split (for hook axis), 8 x 80	2	
59	O461810	割ピン4×25（戻しゴム止用）	PIN, split (for stopping the return rubber), 4 x 25	1	
60	J155060	割ピン5×45（ラチェット軸用）	PIN, split (for ratchet axis), 5 x 45	1	
61	J155061	スナップリング，軸用，70	SNAP RING, 70	1	
62	J155062	サラバネ座金1B（ガイドギブボルト用）	WASHER (for guide gib bolt)	8	
63	J145063	スリワリ付止ネジ丸先2級M8×16	SCREW, M8 x 16	1	
64	J245064	スリワリ付テーパーピン，2.5φ×14	PIN, tapered, 2.5φ x 14	1	
65	O461866	割ピン，10×90（シーブ軸用）	PIN, split, for pulley axis	1	

付　属　品　ACCESORIES OF PILE HAMMER

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
01	J246001	ノズルテスタ	NOZZLE TESTER	1	
02	J246002	カバー，ポール溝	COVER, pawl groove	(1)	ポール溝カバー PAWL GROOVE COVER
03	J246003	ハンドル，ポール構カバー	HANDLE, pawl groove cover	(1)	
04	J116015	掛金	CATCH	1	
05	J246005	スペーサ，ポール構カバー	SPACER, pawl groove cover	1	
06	J246006	保護キャップ	CAP, protecting	(1)	
07	J246007	ロープ，燃料調整	ROPE, for fuel regulating	1	
08	J246008	ロープ，ストップ	ROPE, for stopping	1	
09	J246009	ロープ，リセット	ROPE, for resetting	1	
10	J246010	ロープ，ラチェット	ROPE, for ratchet	1	
11	J156004	安全金具	SAFETY CLAMP	(2)	
12	J116020	排気栓	PLUG, exhaust	4	
13	J156006	安全ボルト	BOLT, safety	1	
14	J127003	ワイヤ，クリーニング 4φ	WIRE, cleaning, 4φ	1	
15	J117078	ジョッキ，オイル	JAG, oil	1	
16	J156017	ラム吊上用具	RAM LIFTING TOOL		
18	J117025	二硫化モリブデン	DISULPHIDE MOLYBDENUM	1	ニチモヌAペースト200 gr 缶相当
	J246019	ポール溝カバー組立	PAWL GROOVE COVER ASS'Y	1 set	
20	J246020	プライミング装置	PRIMING DEVICE	1 set	
50	J146050	グリースガン	GREASE GUN	1	
51	J246051	スプリングピン 6×28AW	PIN, spring, 6 x 28AW	1	ポール溝カバー用

J248000 標準予備品 STANDARD SPARE PARTS (2/2)

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
24	J243307	ニップル	NIPPLE	1	
25	J243308	ガスケット	GASKET	1	
26	J245032	プレート，エンド	PLATE, end	1	
27	J245033	ボルト，締付	BOLT, lock	1	
28	J245035	ばね，ねじり	SPRING, torsion	1	
29	J244008	ナット，ユニオン	NUT, union	1	
30	J244009	ニップル	NIPPLE	1	
31	J244011	フィルタエレメント	FILTER ELEMENT	1	
32	J133506	Oリング1種A・G65	O-RING	2	
33	J244014	鋼管（A）	PIPE (A)	1	

J248000 標準予備品 STANDARD SPARE PARTS (1/2)

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
01	J151008	緩衝ゴム環	RUBBER RING	1	
02	J151017	ニップル，グリース	NIPPLE, GREASE	2	
03	J151019	パッキン（燃料補給プラグ用）	PACKING (for fuel supply plug)	1	
04	J151022	パッキン（燃料タンクドレン抜プラグ用）	PACKING (for drain plug)	1	
05	J122004	リング，ピストン	RING, piston	5	
06	J152104	プラグ，オイラー	PLUG, oiler	1	
07	J243003	プランジャアッセンブリ	PLUNGER ACC'Y	1	
08	J243004	デフレクタ	DEFLECTOR	1	
09	J243005	ガスケット	GASKET	1	
10	J243008	ガスケット，デリバリバルブ	GASKET, delivery valve	1	
11	J243009	ホルダ，デリバリバルブ	HOLDER, delivery valve	1	
12	J243010	Oリング	O-RING	1	
13	J243019	スリーブ，コントロール	SLEEVE, control	1	
14	J243025	ネジ，空気抜	SCREW, air bleeding	1	
15	J243026	ガスケット	GASKET		
16	J243050	ナット，ミゾ付，1種紙形M 12×17.5	NUT, M 12 x 1.75	1	
17	J243051	ピン，テーパ，先割 3×28・S35C	PIN, tapered. 3 x 28, S 35 C	1	
18	J243036	ボルト，円錐	BOLT, conical	2	
19	J243106	リング，ピストン	RING, piston	3	
20	J243105	ガスケット	GASKET	1	
21	J243211	チップ，ノズル	TIP, nozzle	2	
22	J243212	ガスケット，ノズル先端	GASKET, nozzle tip	2	
23	J243213	バネ	SPRING	1	

DISASSEMBLING TOOLS

符号 Ref. No.	部品番号 Part No.	部品名称	Part Name	個数 Q'ty	備考 Remarks
01	J127002	バンド，リング挿入，上部ピストン	BAND, ring installing, upper piston	1	
02	J127001	バンド，リング挿入，下部ピストン	BAND, ring installing, lower piston	1	
03	J127088	取外具，エンドリング	EXTRACTOR, end ring	2	
04	J127024	プライヤ，ピストンリング	PLIER, piston ring installing	1	
05	J117072	スパナ，オイラプラグ	SPANNER, oiler plug	1	
06	J157008	L ー レンチ	L-WRENCH	1	
07	J247001	バンド，ピストンリング挿入，75φ	BAND, piston ring installing, 75φ	1	
08	J247002	弁座抜き具	DRAWING TOOL, valve seat	1	
09	J247003	止輪抜き具	DRAWING TOOL, stop ring	1	
10	J247010	L型レンチ（2.7）	L-WRENCH, 27	1	
50	J217023	ネジ廻し 8×150	DRIVER, screw, 8 x 150	1	
51	J157052	スパナ，メガネ 50	SPANNER, single head ring, 50	1	
52	J127005	スパナ，片口，46	SPANNER, single head, 46	1	
53	J167057	スパナ，片口，30	SPANNER, single head, 30	1	
54	J247054	スパナ，片口，19	SPANNER, single head, 19	1	
55	J167058	スパナ，両口，24×27	SPANNER, double head, 24 x 27	1	
56	J247056	スパナ，両口，13×17	SPANNER, double head, 13 x 17	1	
57	J157054	スパナ，両口，32×36	SPANNER, double head, 32 x 36	1	
58	J247058	スパナ，六角棒，12	SPANNER, hex., key, 12	1	
59	J147051	スパナ，六角棒，32	SPANNER, hex., key, 32	1	
60	J247060	メガネスパナ，片口，19	SPANNER, single head, 19	1	
61	J157062	ペンチ，スナップリング取付	TOOL, for snap ring	1	
62	J157060	工具箱	TOOL BOX	1	
63	J247063	スパナ，六角棒，8	SPANNER, hex., key, 8	1	
64	J117012	スパナ，六角棒，17	SPANNER, hex., key, 17	1	